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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Foundry, Boiler Shop and Machine Shop Designed and Built by the Berlin Iron Bridge Co.

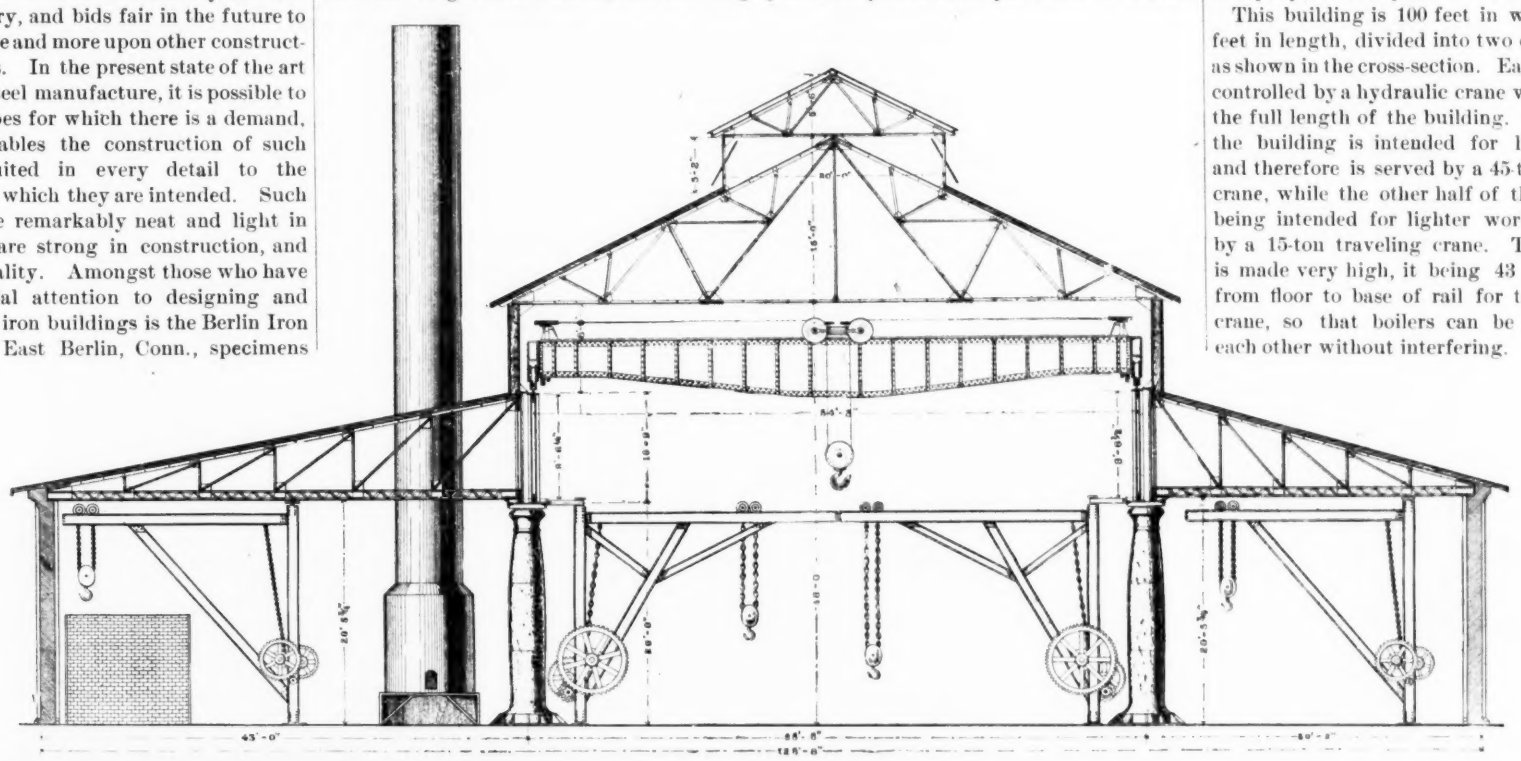
Within the past few years iron and steel in the construction of buildings for industrial purposes has come extensively into use in this country, and bids fair in the future to encroach more and more upon other constructive materials. In the present state of the art in iron and steel manufacture, it is possible to get any shapes for which there is a demand, and this enables the construction of such buildings suited in every detail to the purposes for which they are intended. Such buildings are remarkably neat and light in appearance, are strong in construction, and lasting in quality. Amongst those who have given especial attention to designing and constructing iron buildings is the Berlin Iron Bridge Co., East Berlin, Conn., specimens of their design and construction in the way of a foundry, a boiler shop and a machine shop being shown on this and succeeding pages.

The cuts on page 1 represent a cross-section and an interior view of a foundry designed and constructed for the Farrel Foundry and Machine Company, of Ansonia, Conn.

The building is 128 feet 8 inches in width by 301 feet 4 inches in length. In cross-section it is divided into a central portion 55 feet 6 inches center to center of columns, with one wing 30 feet 2 inches, and one wing 43 feet. The central portion is served by two hydraulic cranes having a capacity of 50 tons each. Supporting these cranes are longitudinal lattice girders of 50 feet span, supported by cast-iron columns, these columns being thoroughly anchored to the masonry piers, which extend 15 feet into the ground. Between each set of columns there are placed jib cranes, which swing completely around so as to control that portion of the floor between inside of the wings and outside ends of traveling cranes. Besides these jib cranes, in the wings at different points are placed other jib cranes to control the floor space in this part of the foundry. Every inch of the floor space of the foundry is therefore under the control of power, so that molten iron can be taken from the cupola and delivered to any part of the foundry by means of power, and finished castings can be delivered to the outside doors in the same way. The interior of the building is lighted by glass in the roof of the ventilator, the sides of the ventilator being made of iron louvres, which open and close by hand.

On page 2 is shown a boiler shop for the Newport News Shipbuilding and Dry Dock Company, of Newport News, Va.

This building is 100 feet in width by 300 feet in length, divided into two equal spans, as shown in the cross-section. Each portion is controlled by a hydraulic crane which travels the full length of the building. One side of the building is intended for heavy work, and therefore is served by a 45-ton traveling crane, while the other half of the building, being intended for lighter work, is served by a 15-ton traveling crane. The building is made very high, it being 43 feet 5 inches from floor to base of rail for the traveling crane, so that boilers can be moved over each other without interfering. The outside posts are provided with hydraulic cranes of 5 tons capacity, and each machine is provided with proper cranes for handling the work required. The light is furnished by three rows of windows on each side below the traveling cranes, and above the traveling crane there is placed a fourth row of smaller



FOUNDRY BUILT BY THE BERLIN IRON BRIDGE COMPANY.

windows to light the upper portion of the building. Besides this, the roof of the ventilator, which extends the full length of the building, is made of glass, so that the interior of the building is well lighted, and the light is well diffused. The ventilators are provided with swing shutters, which open and close by cords from the floor, so that they can be worked separately and independently in each panel. From the floor to the underside of the roof trusses is 54 feet 1 inch. The framework of the building is entirely of iron, but the outside walls are made of brick, placed between the iron posts, and braced and held by iron braces connected with the posts.

The cut on page 3 represents a machine shop for the Titusville Iron Company, of Titusville, Penn.

The building is 70 feet in width by 205 feet in length, inside of walls. The roof trusses are made of iron, and so arranged as to carry shafting. Along the central portion of the building is a row of iron columns. The trusses are placed 10 feet apart. Where large amounts of shafting are to be carried from the roof, iron trusses are better adapted for the work than wood, as they are stronger and stiffer, and there is no danger of their shrinking and swelling from the action of the weather. An iron truss when placed in position will stand firmly, and carry its load without vibration or deflection.

It is said that the Japanese government are going very extensively into the building of a navy, and expect, in this respect, to be eclipsed by but few countries in the world. British shipyards are likely to reap the benefit.

A London dispatch says: A Board of Trade return, just issued, shows the large decrease in the hours of labor during the past ten years, which is bringing the eight-hour limit nearer and nearer. Bakers who, a decade ago, worked seventy-two hours a week, now work fifty-four hours; miners formerly sixty hours, now thirty-eight and forty-eight hours. Workmen of all trades now average fifty-four hours weekly, or nine hours a day.

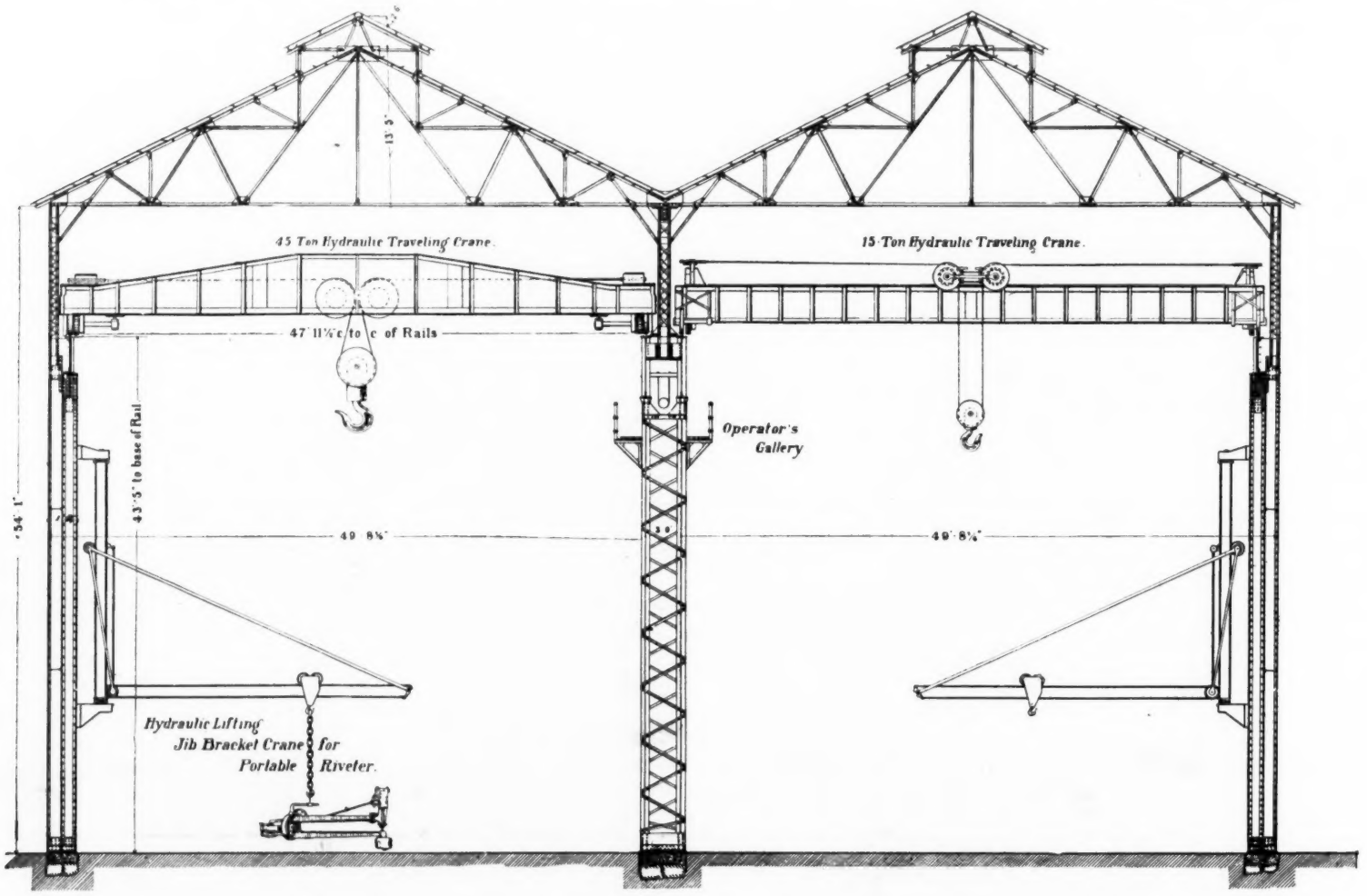
The Spanish Cruiser "Pelayo."

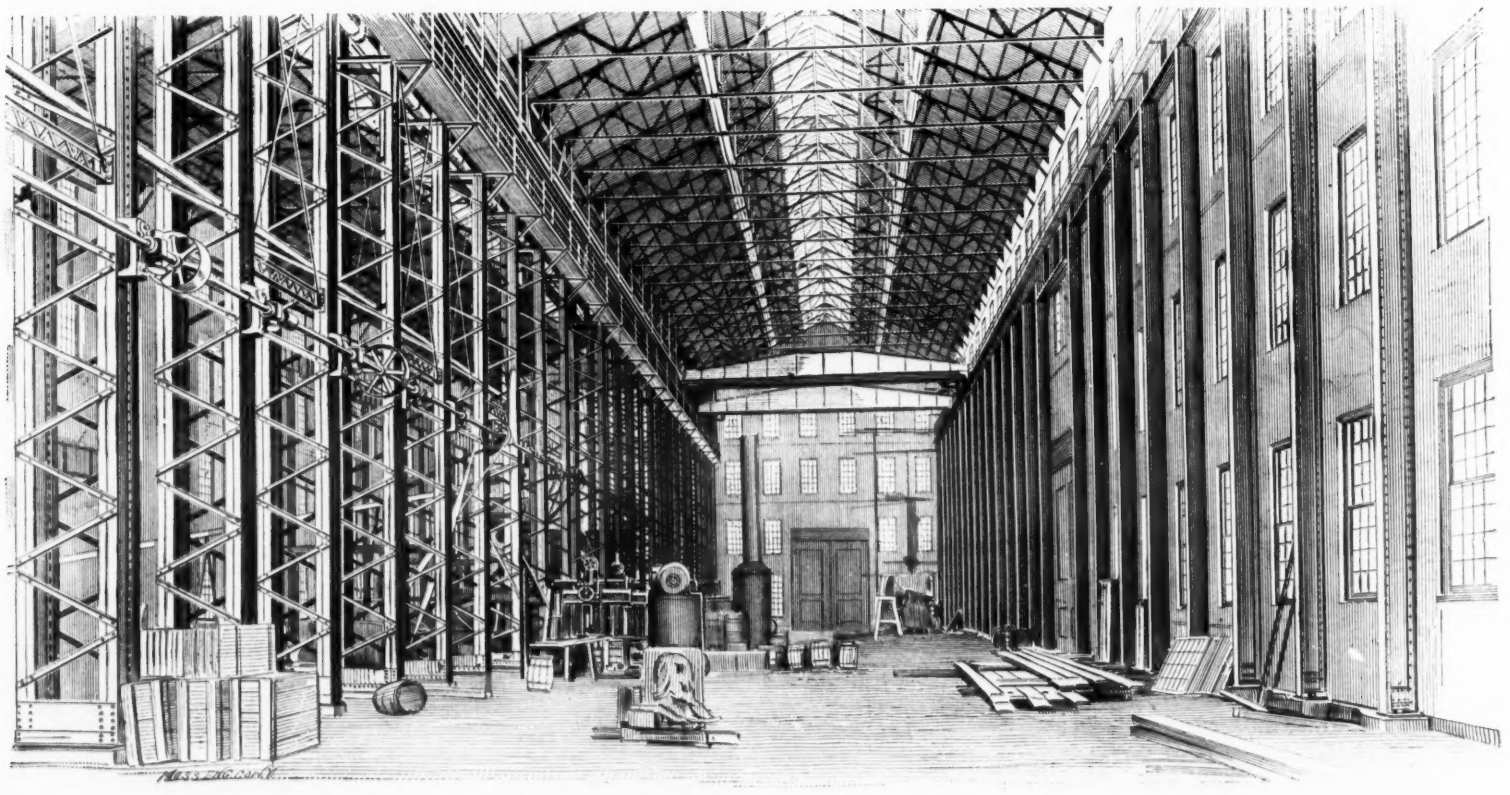
The first-class cruiser "Pelayo," which has recently been added to the fleet of Spain, was constructed by the Compagnie des Forges et Chantiers, at their works of La Seyne, near Toulon. All the plans for the hull of this ship were prepared under the direction of M. Lagane, director of the La Seyne works, and the engines were designed by M. Orsel, chief of the Mepenti works. The following are some of the leading dimensions of the vessel:

Extreme length	346 ft. 5½ in.
Width at water line	66 ft. 3 in.
Depth of hull amidships	24 ft. 1¼ in.
Draught of water, aft	24 ft. 9¼ in.
Displacement	9,900 tons
Indicated horse-power, with natural draught	6,800 tons
Speed obtained during trials (natural draught)	15 knots

The "Pelayo" is constructed of steel throughout, and all the metal employed, which was made in France, was subjected to the same tests as those prescribed by the French Navy Department.

The armament of the "Pelayo" is as follows: (*a*) A heavy steel spur which forms a part of the framing of the ship. (*b*) Two Hontoria guns of 32 centimeters (12.60 in.) mounted, one forward and the other aft, in two Canet barbette turrets. (*c*) Two Hontoria guns of 28 centimeters (11.02 in.) on Canet mountings, and placed almost amidship, one on each side. (*d*) One Hontoria gun of 16 centimeters (6.29 in.) placed quite forward and available only for chase firing. (*e*) Twelve Hontoria guns of 12 centimeters (4.72 in.) placed six on each side in batteries, and mounted on Canet carriages. (*f*) A large number of quick-firing guns and revolving cannon, distributed over the decks in the double tops of the military masts and other places. (*g*) Seven torpedo firing tubes on the lower deck above the armored deck.


45 Ton Hydraulic Traveling Crane.
15 Ton Hydraulic Traveling Crane.
47' 11½" to c of Rails
43'-5" to base of Rail
54' 1"
49' 8¾"
49' 8¾"
Operator's Gallery
Hydraulic Lifting Jib Bracket Crane for Portable Riveter.



Boiler Shop Built by the Berlin Iron Bridge Company.—See Page 1.

The barbette turrets, in which the 32-centimeter guns are placed, are protected with steel plates 15.75 inches thick; the turrets are supported on a framing also protected with steel plates 7.87 inches thick, extending down to the steel deck, and serving as a protected passage for the ammunition hoists. The forward turret for the 32 centimeter gun is placed at such a height that the axis of the gun is 31 feet 2 inches above the water line, and is so mounted that it has an angle of 250 degrees. On account of the relatively great height above the water, this gun can be fired in any kind of sea. The rear gun, also 32 centimeters, has a total firing angle of 220 degrees. The broadside guns of 28 centimeters can each fire through an angle of 180 degrees, or parallel in each direction with the keel of the vessel; they are thus equally available in chasing or retreating.

The official trials of the machinery were divided into three series. The first referred to the speed obtained with natural draught, and with the hatches of the stokeholds remaining open. A minimum speed of 15 knots was guaranteed, this speed to be the general mean of four runs on a course of 6.712 knots. The second trials were with a moderately accelerated draught; in these the pressure of air forced into the stokeholds was not to exceed 30 millimeters of water, and the object of the trial was not to ascertain what increase of speed could be obtained, but that all the machinery, etc., worked well under the modified condition. The third trials referred to the consumption of fuel.

The results obtained were considerably in excess of the guarantee, 16.20 knots, instead of 15 knots, having been obtained with natural draught. The coal consumption at 12-knot speed and per twenty-four hours was 45 tons, instead of the prescribed maximum of 70 tons. At the normal draught of water the "Pelayo" can carry 800 tons of coal, a supply sufficient, with a speed of 12 knots, to cover a distance of from 4,500 to 5,000 miles; reduced to a speed of 10 knots, the steaming capacity would be 7,500 miles.—*London Engineering.*

A Curiosity which Annoyed the Inspector—A Precaution.

BY JARNO.

I do not mean the kind of curiosity exhibited by the fellow that discomposes one by asking what there is new in this week's AMERICAN MACHINIST, just as one is tearing off the wrapper. This fellow is more curious than logical, as he does not appear to recognize the difficulty of telling what is in the paper before looking at it.

The inspector is a well-established official in our larger machine shops, and is becoming more common in smaller ones. He is a sort of indicator for the mental atmosphere of the whole workshop, and oftentimes his influence extends into the office. When he is good-humored all is pleasant; when he does not feel well things are awry. It has been said that more unpleasant sensations are excited through the nose than through every other organ of sense. Our inspector is fearful lest he be a party to offending the ear; he is easily disturbed by noise, and especially by the noise of gears. He does not as yet have any noise meter, and so in passing judgment upon noise his imagination has unrestrained liberty. However nice the distinction, our inspector can always tell whether gears are too noisy, or just noisy enough.

Now he finds something more definite; a spindle is out of true, showing an eccentricity of one two-thousandth of an inch, and giving an arbor, held in the spindle hole, a throw of one one thousandth of an inch in extreme, which is too much to be allowed to pass. The foreman is called, and then the workman, who says that the spindle was true when it left his hands. The foreman leisurely turns the spindle a few times, looks at the indicator, and, behold, the spindle runs true! Why does it run true at one time, and not at another?

The holes in the spindle-boxes are one one-thousandth of an inch larger than the spindle bearings. When a bearing is oiled, and the spindle is running, the oil is about equally spread over the bearing. But when the spindle stands still for a few minutes it settles, so that the under side of the bearing touches the box, and the oil is forced to the top. Now, when the spindle is started up an eccentric of oil is carried around by the bearing, and a cam of oil is held by the box, and, until the oil is distributed, the spindle does not run true. The spindle will often run out of true for eight or ten turns. Upon stopping the spindle the indicator at once shows that it is settling down through the oil. If the boxes are not in line the spindle bearings may be held to one side, so that the spindle cannot settle, and there will be no oil eccentrics or cams that will have any effect. If a spindle does settle, upon being stopped, we have evidence that the boxes are in line. Hence, the curiosity that annoyed our inspector might have been an evidence of good work rather than of bad. This matter of a spindle's running out of true, when first started up, is no longer a curiosity among good mechanics.

In starting up a planer or a grinding machine, in the morning or afternoon, it is often well to take the precaution to let it make a few strokes before beginning to cut. A planer table takes a different position, after standing for a while, and if the tool is allowed to cut on the first stroke after starting, it leaves a mark. This especially holds in taking a finishing chip. Some planer men will not begin a finishing chip unless there is time to carry it across before the power stops.

Not a New Proposal.

Not long since we had something to say regarding the injury to our patent system likely to result from such doings as that of the Bell Telephone Company, which, by obtaining control of both sides of an interference case in the Patent Office, was enabled, so far as that case was concerned, to defeat the objects for which patents are granted.

Practical Mechanics takes it for granted that because we did not refer to its favorite scheme for reforming this and other evils of the patent system, we were ignorant of such a scheme having been proposed; says we are "still in darkness," and advises us to read up in these matters.

The assumption that because we fail to endorse a particular remedy for recognized evils, we are therefore ignorant of that remedy having been proposed, is a violent one. The alleged remedy in this case is to issue a patent to any one applying for it in proper form, without regard to what may have been done previously in the same line, and then let the status of the patent so granted be determined by the courts.

This plan did not originate with *Practical Mechanics*, however, and we think was proposed before our contemporary was born.

While there are many things that can be said in its favor, we do not see that it would be such a cure-all as it is claimed it would be. So far as we can see, it would result in increased business for lawyers, at the expense of inventors and mechanics, and such companies as the Bell would be able to hire the best ones, and would still be at an advantage.

The remedy for such evils as we referred to is to be found, we think, in so amending the law that the parties interested in an interference can be compelled by the Patent Office to proceed with the business within a reasonable specified time, in default of which the patent shall issue to one or the other, or be finally refused to both.

Plans for the ship canal which is to connect Paris with the sea are now said to be completed.

The Consulting Engineer.

How far is it wise for a manufacturing firm to depend on its own resources in adding to or making changes in their working plant? Where the members of a firm are already fully occupied, the manager and foreman busy each month in keeping up a uniform delivery, who is to make additions to plant and buildings, look up the latest improvements in the art of manufacture, by travel, ascertain the experience of other firms with the latest improvements, or, to sum it up in other words, how to be in a position of "up to date"?

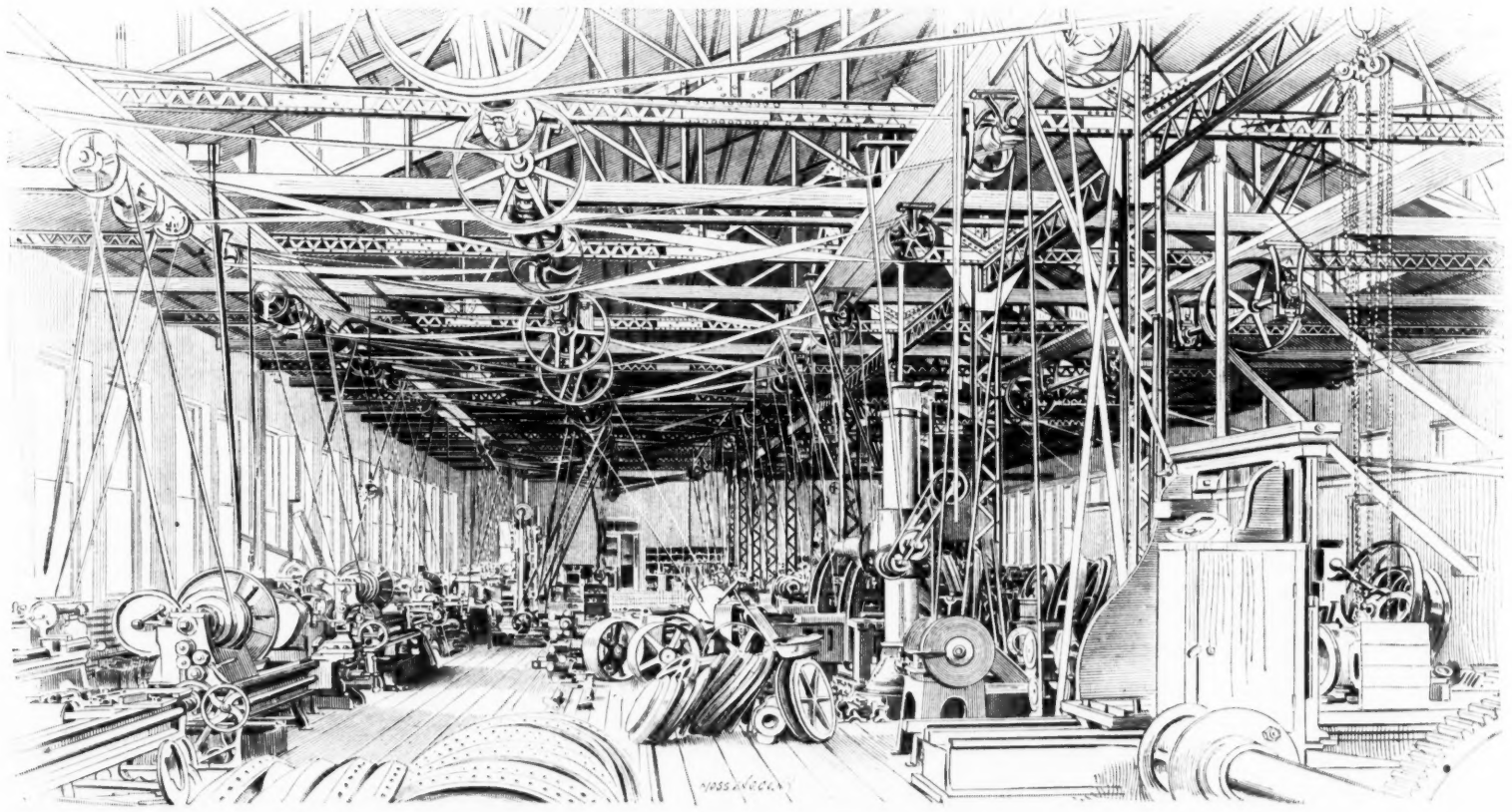
When a new building is wanted, it is placed in the hands of an architect. If a new boiler and engine of large power is wanted, advice is taken from a boiler inspection company. But here it generally ends. If a new cupola, core oven, foundry crane, molding machine system, railway of narrow gauge, etc., are wanted for the foundry, the manager must decide all these matters, although he may not for many years have been obliged to know of the latest and best systems.

New pumps and water supply are wanted and a new furnace for the forge, more forging plant, some new tools of the latest design and highest production are required, a quantity of electrical plant is to be added, and so on almost without end.

There may be a few firms who have the general knowledge and skill within themselves to select the best appliances, but in a general way I think it is a risky basis for business. A firm of consulting engineers who have made it a study to have kept thoroughly posted by travel in this country, on the Continent, and in America, and besides, have all the information in carefully preserved catalogues and papers, would certainly be a paying investment to those who could make use of this knowledge.

It is the "division of labor" problem again. It requires time and application for an engineer to keep himself fully acquainted with all the advances that are being made in each branch of engineering, and it is doubtless better policy to depend upon the judgment of those who make a specialty of acquiring this class of information, than to depend upon those who are already fully engaged in their daily occupations.

The subject has been called to my mind by having recently been brought in contact with a number of alterations and improvements introduced into a large works by a firm of consulting engineers. Both are comparatively young men, but with a thorough education, and knowledge obtained by wide reading and travel. It is possible for such a



MACHINE SHOP BUILT BY THE BERLIN IRON BRIDGE COMPANY.—SEE PAGE 1.

firm to be engaged at one time in advising upon changes in a number of works, so that the expense in the management of any one of the works would be reduced for the time being, and, instead of additional cost, there would probably be a saving.

Consulting engineers have, for a long time, too often been regarded as merely standing as an unnecessary element and expense between the purchaser and the manufacturer; but it is evident that, with the wide range of change and improvement going on, coupled with the gradual division of manufacturing specialties, that the profession of a consulting engineer will be more fully recognized and considered as a "good investment" to every one making use of his services.—*Mechanical Progress.*

Tapping Jigs.

By Bell Crank.

In the American Machinist of March 12, "A Mechanic" described a tapping jig, which calls to mind the experience I have had with such jigs. James Nasmyth, in his autobiography, describes one which he invented, and claims to have used successfully. I have seen them used, but they were not entirely satisfactory. It is simply a round piece, with a flange at one end, it being bored to fit the shank of the tap, and counterbored for the body of the tap, and faced on the flange square with the hole. The shanks of ordinary hand taps, which are sold by the tap makers, are too short to be used with a stationary guide, that is, a guide which does not follow the tap as it goes in.

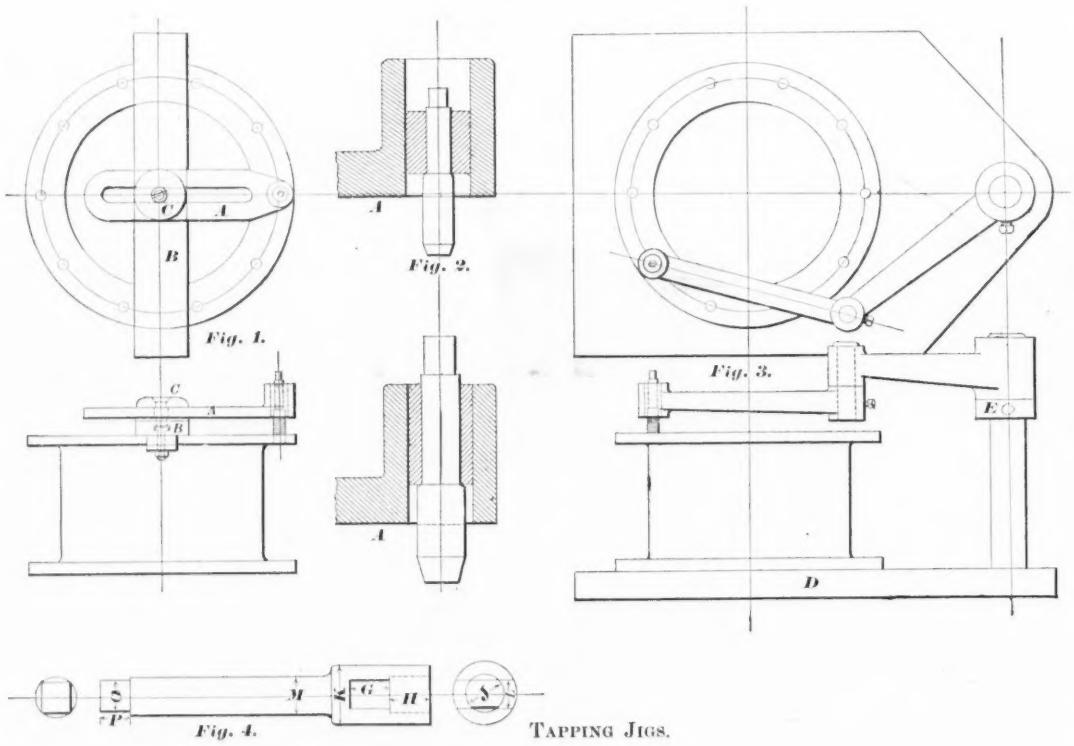
There are two objections to the jig described by "A Mechanic." First, it needs an extra centering piece to locate it correctly; and second, after being located it must be bolted fast. In all ordinary hand tapping, it is considered accurate enough to allow the tap to center itself in the hole that is drilled for tapping, and all a jig would then be needed for would be to keep the tap square with the surface, or in line with the drilled hole. Several years ago I devised a jig for that purpose, and arranged it to use the regular sizes of hand taps. It consisted of a slotted plate *A*, Fig. 1, mounted on another plate *B*, and held in place by washer *C*, which allows plate *A* to slide endways, or turn around, but is a close moving fit under the washer. At one end of plate *A* is a boss bored to receive bushings for different sized taps, being a neat fit to their shanks, as shown in Fig. 2.

In Fig. 1 the jig is shown in position for tapping holes in the flange of a cylinder, the plate *B* being held to the cylinder flanges by clamps and bolts, with the heads in a T-slot in the plate.

This is a portable rig, but Fig. 3 is a plan for a stationary table *D*, with a post fixed in it at right angles to the surface, the post supporting a swinging jointed arm for receiving the tap-guiding bushes. A set collar *E* allows the arm to be adjusted for different heights of work. The table *D* should be set solid and level, so that a piece may be set with a spirit level, and then be square with the tap guide. If this table was large enough, and had slots in it for bolting the pieces fast, it would be a good thing to have in the erecting shop in charge of a man to take care of and do the tapping. It will be seen that this jig does nothing toward locating the tap, its sole function being to hold the tap perpendicular to the surface being operated on, so that any number of holes may be tapped parallel to each other and perpendicular to a plane. This kind of jig can be kept up from the piece enough to allow oil to be applied to the tap as often as desired—a feature not found in any other I have seen.

The standard taps were found not to have uniform sizes of shanks, and it was necessary to reduce the size slightly, so as to have them all the same on a given set.

In using this jig a set of socket wrenches were needed for the taps, and in Fig. 4 is shown a plan of making them which is better than the common form. It is frequently convenient and often necessary to use socket wrenches on taps, and with the ordinary kind it is very difficult to start a tap straight, because the square end on the tap soon gets to be a loose fit in the wrench, and wobbles too much. This one is bored at *J* to fit shank of tap below the square, and a mortise the size of the square part is put through at *G*. The outside diameter *K* should be turned concentric with the bored hole, so as to be used to try a set square against when being used without a jig. With this kind of a socket wrench, it is very easy to start a tap straight, but they are not safe in the hands of a careless workman, because, after the tap is partly entered, if the wrench is long, a side strain on it will break the tap. I have used them with entire satisfaction, and prefer them to regular, adjustable double-ended wrenches, for it is so much easier to start a tap square with them. They might be preferably made with the handles forged or fixed on them, and properly proportioned in length to the tap they belong to.



Tapping Jigs.

The accompanying table gives some of the dimensions for wrenches for taps from $\frac{1}{2}$" to $1\frac{1}{4}$" diameter, except the length, which may be made to suit circumstances.

Size of Tap.	G	H	J	K	L	M	O	P
$\frac{1}{2}$	$\frac{9}{16}$					$\frac{7}{16}$	$\frac{5}{16}$	$\frac{7}{16}$
$\frac{9}{16}$	$\frac{5}{8}$					$\frac{1}{2}$	$\frac{5}{8}$	$\frac{9}{16}$
$\frac{5}{8}$	$\frac{11}{16}$					$\frac{9}{16}$	$\frac{5}{8}$	$\frac{5}{8}$
$\frac{3}{4}$	$\frac{11}{16}$					$\frac{5}{8}$	$\frac{1}{2}$	$\frac{11}{16}$
$\frac{7}{8}$	$\frac{13}{16}$					$\frac{5}{8}$	$\frac{9}{16}$	$\frac{3}{4}$
1	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{13}{16}$	$1\frac{1}{4}$	$\frac{5}{8}$	$\frac{7}{8}$	$\frac{11}{16}$	$\frac{3}{4}$
$1\frac{1}{8}$	$1\frac{1}{4}$					$\frac{7}{8}$	$\frac{11}{16}$	$\frac{13}{16}$
$1\frac{1}{4}$	$1\frac{1}{4}$					1	$\frac{3}{4}$	$\frac{13}{16}$

Trade Schools.

By Peter H. Bullock.

Professor Sweet, in what he had to say on trade schools, so nearly voiced my own ideas that perhaps I may be able to bring but little new thought to the subject. I am perfectly aware, as he said he was, that an opinion exists that trade schools are not practical, and that they are quite generally opposed by mechanics. The professor outlined a plan whereby he thought such a school might be self-sustaining. Of this there can be but little doubt, provided it should be run in a practical way, and with the intention of producing intelligent mechanics, instead of educated young men with a veneer of manual and mechanical training. I do not undervalue the great advantage of a technical education, supplemented with such shop experience as most technical institutions are able to furnish with their very complete mechanical outfits, and the careful, although limited instruction therewith, but the very extended course that such instruction usually covers makes the actual knowledge gained of each trade or subject little more than superficial. Yet, let us keep in mind the fact that the graduates of technical schools are not mechanics—we will admit that they are something better, perhaps, yet not mechanics in the sense the term is usually applied.

In view of the fact that while the graduates of technical schools are sometimes found acting as foremen or draftsmen, and are seldom if ever found working as mechanics, it must be admitted that such schools are failures so far as producing the latter necessary class. A process might be carried out that was intended to produce a certain thing, and although the result might be a superior product, yet that would not satisfy our requirements for the simpler, plainer thing.

"Wanted—May 1st, 1893, fifty young machinists for general work."

Should an advertisement like the above be published in the American Machinist, and signed by responsible parties, I think the contract could be filled, and with young men that do not at this moment know the difference between a milling machine and a saw arbor. Some men that spent three, five or seven years at their trade will think this a pretty short apprenticeship. Well, it is; and a good many other things are now done quicker than they were forty years ago. I have never felt convinced that a good deal of the work performed by apprentices under the old regime was of much value to them in acquiring their trade, but was more in the nature of a contribution to a sinking fund to offset the possible and probable losses that are inseparable from the efforts of new beginners.

The plant and facilities necessary to instruct young men to fill such a contract would be a well-equipped tool room, with a plenty of land in the rear on which to erect the shop should such an addition be thought necessary, and to afford the New Method Ball Club a plenty of space to win or lose occasionally in the national game. It would also be necessary to have a half dozen mechanics who know how to do good work, and an inclination and willingness to impart their knowledge to others, and a plenty of ordinary plain, practical work, just such as other shops make and turn out every day. The raw material should be one hundred young men of average intelligence and ambition; I would only bar dudes and hoodlums. Time for the delivery of the workmen, two years.

Now let us define what we think a machinist must know. In general terms he is a man that can drill, turn, bore, plane, mill, chip and file iron, steel and other obdurate metals. He must be familiar with all ordinary shop tools, and be able to both operate and keep them in repair. He must also be able to understand and work correctly, and to scale, from a drawing. The man that can do these things comes pretty near being a good machinist, one that any sensible shop owner would be glad to hire if he was sober and reliable. Let us keep this standard in view, and try to attain the object. This is a departure from the technical trade school, and the object is clearly defined; we are simply to learn young men to be machinists, and how to do work just as other people do it in regular industries. Now how much more is required of a man than that he be able to do this in order to get the highest ruling rate of wages? In other words, how much more could such a man get as a *machinist* if he has a good technical education, and is a finished or fair draftsman? If he had given good satisfaction in the shop as a workman, and should ask for more pay from the fact of having these accomplishments, would anybody give it to him as a workman? You will see that I am sticking to the fact that the product was to be *machinists*, not foremen, draftsmen or superintendents, and there will be no time to teach things that are necessary only to the latter class.

All things human are uncertain, and so would be the result in the case of the raw material we should have to deal with. Without doubt, among the hundred there would be a few born merchants, doctors, and, perhaps, editors, and the number would quickly at first, and slowly after a few months, drop off, but even at the expiration of the contract time for the delivery of the fifty machinists we might have a small job lot above that number that could be thrown in with little loss or gain to either party.

How would the scheme work? Again, things human and untried are uncertain; but I will prophesy a little, taking myself as a sample subject, for if any of the one hundred were more stupid than I was in my apprenticeship days, they would be dropped the first week, and therefore would not be a factor in the problem. Yet with minor advantages and major disadvantages I finally arrived at the middle chamber of the craft, and have, in years gone by, earned a good many dollars by the sweat of my brow and the forbearance of my employers.

As the object would be to teach these young men how to do machine work, a much shorter term at cleaning castings than was required in my case would be sufficient. It would be necessary to keep in mind the fact that in this practical school the social conditions will have to differ materially from what obtains in other shops or industries, for there the owners must insure themselves against losses in the way of broken tools and poor work by employing apprentices at laboring work enough to pay the premium on such losses as will surely be made. In case of the school it would be the policy to make these losses as small as possible by careful instruction and timely caution, and to increase the value of their services by getting the boys advanced as fast as possible. The mechanical and manufacturing part of the business should be exactly the same as any other similar enterprise, the only difference being that all the employes would have to be taught the business.

Of course, castings would have to be cleaned, the shop swept, the sink pipe cleared out, and the snow shoveled off the side

walk, but an intelligent foreman would soon find the coming members of the job lot of misfits, and it is good judgment to allow such to be hewers of wood, etc., etc. Some men will do excellent service with a crowbar, and still be colossal failures in managing a float file or a turret lathe. On general principles, do not ask a mechanic to do work that can be done just as well by common labor, for it lowers the man in his own and others' estimation; and it does not pay to use skilled men for laboring work any more than it would pay to transport coal in a Pullman car.

It seems to me that the most sensible thing to do in the case of the supposed school would be to get the material at hand into useful condition as soon as possible, keeping in view the fact that to be truly useful the man must know how to do more than one thing. Therefore, after a boy had got to know about drilling holes, and could determine the proper speed for different sized drills, and in different metals, and when to use oil, and when not to, he could profitably be taken over to a hollow spindle lathe, and set to cutting off a lot of blanks for studs. Show him all about the machine, and tell him as much as he can understand and remember, and no more. Tell him not to go ahead unless he is *sure he is right;* tell him to cut these blanks 4″ long, not 3¾″ or 4¼″, but just 4″. It will not be very long before he can operate that machine all right, and when he has about ten per cent. more cut off than you want, let him take them over to the speed lathe and center them, then have him size them, and, finally, cut the threads. Some may say this is getting ahead pretty fast to have a fellow cutting threads within a month or even less of his introduction into the business. Well, so it is, and that is just what the school would be for. This young man would probably have had more actual instruction, and had more things explained to him in that time, than you and I had in the first year of our apprenticeship. When he got through with this job he could make a stud complete from the bar-iron; he might not have to do it in other shops, but he would know how.

At the end of three months there should be fifty that can do two things well, twenty that can do one thing fairly well; fifteen born for other pursuits have discovered that they were on the wrong track, and have been set off on other sidings. That leaves fifteen about which the future is very uncertain, but there must be a reserve for criminals, politicians and congressmen, like the sentry who defined his duty to the inspecting officer as being to allow no one to pass out of the lines, and nothing in except hogs, niggers, and officers.

The particular abilities of each young man should be especially watched and cultivated, and if it becomes apparent that he is to be a planer specialist let him develop in that direction; the world needs planer specialists, and thus with all the tools. Be ever ready with a word of explanation as to the character of the work in hand, and the why and wherefore of the different processes, and also with the timely word of caution as to being over self-conscious of budding abilities.

I well remember how my bosom swelled with pride when I was given my first crank-pin to fit, and I also remember the peculiar famished feeling that took possession of my stomach when that pin dropped clear up to the shoulder in the hole it was intended for. I am honest in my belief that a word of caution from the foreman would have saved that pin to the concern, and a lot of mental anguish to myself.

Perhaps a casting of uneven surface is to be planed; call a dozen of the boys that are on that kind of work around the planer, and put in ten minutes talking to them. It will show them that you have an interest in their learning, and that you know what you want, and the reason why. Show them that if they strap it down without shimming up the point that don't touch the platen, that the binding bolts will spring it down, and that it will spring back again, and be out of truth when taken off. Give them these little object lessons; they will always remember them, and as they advance in handicraft let the talks be still further ahead; lead, not drive them along. Encourage them to ask questions, and let your answers be in plain, every-day language; do not try to teach them the theory of things before they know the substance thereof. What is the use of talking angles, sines and cosines to an apprentice who does not know how to grind a lathe tool properly? Show him how to grind and set the tool, and why it cuts better when so set and ground, and he will get on to the angle part as soon as he needs it.

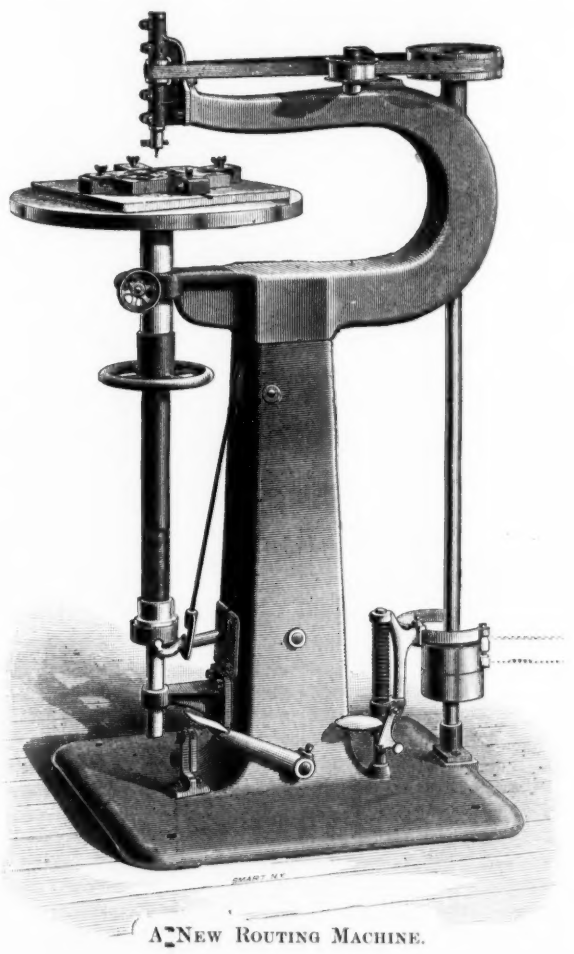
Not being a seventh son, etc., etc., perhaps my prophecy will not be of value, but I imagine that in about one year there would be in such a shop about thirty that you would be proud of, about twenty that were doing well but learning slowly, a few that would make good specialists, and a few that will never make fine workmen, but who will learn the business, and eventually become proprietors of shops. Some will remain unclassified for some time yet, and may finally come to the surface.

As to drawing, I should be in favor of those who desired to learn having a chance, and the same might be said of technical lectures; there is no danger of any young man knowing too much of useful things. I have said that a good machinist must be able to understand, interpret, and work from a drawing, and will now add that he may be just as good a *machinist* if he is unable to make one. Making drawings is another art, and a very desirable accomplishment, yet it cannot be claimed to be a necessary part of a machinist's trade, and as the contract was for machinists, and the time quite limited, we must dismiss the ideas of teaching them another trade, but we will encourage it among the boys just as we would surveying, amateur photography, and the manly sports.

The business part of this scheme must be discussed by others, as there is nothing in my own experience that would lead me to predict anything but bankruptcy; yet it seems as though the enterprise might be made to pay its own expenses, and have a little on the right side of the ledger to divide among the boys.

A good mechanic can stand in the presence of great wealth or political renown without any feelings of inferiority, for if placed where each must depend upon his own exertions for a livelihood, the former has the resources of success and maintenance as an attribute of, and within himself; not so with the others. It should therefore be impressed upon the young men that they were engaged in acquiring an honorable occupation, and that if they respected themselves, others will also respect and honor them.

I believe in the great American boy; I think he wants to learn, and is quick to do so if he sees an interest is taken in him. I think he had rather be a good machinist than an unsuccessful lawyer, and a respected young man than a hoodlum. I believe that the trade school shop could complete its contract.



A New Routing Machine.

A New Routing Machine.

The accompanying illustration represents a routing machine of very simple design. A rigid overhanging arm, above a vertically movable table, supports a cutting spindle of steel, which can be run at 6,000 to 8,000 revolutions per minute. It is driven by an endless belt, arranged with a "binder pulley" for governing the tension. The vertical shaft, extending to the base of the machine, affords a convenient mode of driving, which effectually eliminates tremor that otherwise might be imparted from the driving belt. For starting and stopping the machine there is provided a convenient pedal shipper, which may be arranged to receive the driving belt from various positions of the countershaft.

On this machine the work to be routed is secured to a movable holder, or loose iron plate, and passed beneath the cutter over the surface of the table by hand. This plate possesses sufficient inertia to resist the rotative force of the cutter, which enables the operator to move the work readily in the desired direction. Suitable clips, arranged in slots, are provided for fastening either mounted or unmounted plates to the work holder.

The table may be moved vertically for entering the cutter, and for withdrawing the same from the work, by means of a conveniently arranged pedal for the right foot. A hand-wheel beneath the table provides an adjustment for controlling a uniform depth of cut. The table is also nicely counterbalanced by a weight suspended within the column of the machine, making the movement of the table very sensitive, enabling the operator to make rapid changes of the cutter from space to space, and to control delicate gradations of depth in the cutting.

The adjustment for depth, combined with the vertical movement of the table, permits the machine to be successfully used for boring nail holes in zinc and electrotype plates, or for boring out mortises if desired. Indeed, other purposes for which the machine could be used have been suggested, but the design being comparatively new, the builders have not had the opportunities for testing all the capabilities of the machine. But it has a capacity for large work of the kind for which it was designed, and requires comparatively a small floor space; on this account it is very suitable in places where room is an object of importance. It is claimed that this machine will meet all the requirements in newspaper offices and publishing houses, or of electrotypers, photo-zinc etchers, and others needing an inexpensive router for cutting down large surfaces on engravings or plates of any kind.

The work holder is 12 inches square, and it will take in plates to 9 inches in width. The driving pulley is 5 inches diameter by 2¾ inches wide. The speed of the countershaft should be 625 revolutions per minute; length of countershaft is 10½ feet; the floor space required is 24x31 inches; the main belt should be 1¾ inches wide; the arm overhangs 18 inches, and the weight of the machine is 350 pounds.

This machine has recently been brought out by John Royle & Sons, Paterson, N. J. Their aim in designing it was to produce a routing machine of economical construction, having a reasonable degree of efficiency, at a moderate price.

LETTERS FROM PRACTICAL MEN.

Long Pistons.

Editor American Machinist:

I was recently reading the papers of the late Dr. Joule, of Mechanical Equivalent of Heat fame, and in a short note of the proceedings of the Manchester Literary and Philosophical Society, date Oct. 21, 1862, that is, nearly 30 years ago, came across Joule's reference to the possibility of using deep pistons in place of packing rings.

He was referring to the difficulty of working superheated steam or hot air in metal cylinders, owing to the want of a suitable lubrication capable of standing the high temperature, and the consequent rapid destruction of the cylinder. The mineral oils in those days were of course little or not at all known, or, if known, had not been prepared as we now know them suitable for even such high temperatures as obtained in gas engine cylinders.

Joule stated that he believed the necessity for using elastic packings would not exist if the length of the channel along which the elastic fluid must pass, in order to arrive at the opposite side of the piston, were sufficiently increased.

He went on to say, "This might be accomplished *by increasing the depth of the piston*, or by placing on the rim of the piston concentric rings to enter, at the beginning and ending of each stroke, corresponding grooves in the cover of the cylinder."

Though I confess I do not see clearly how the latter idea is to work, there is no difficulty in understanding the deep piston idea.

Joule then says:

"The principle of great depth of piston as a substitute for packing has been successfully carried out in the pump which formed the subject of this communication." The following particulars of the pump are given as follows:

There are two cylinders, each 2 inches diameter by 20 inches long (the stroke being evidently 10 inches). The pistons are solid cylinders of iron, 10 inches long, and turned to as closely accurate a fit in their respective cylinders as was consistent with freedom of motion. The great depth of the pistons as compared with their diameters is such as to render unnecessary the usual guide or parallel motion, and the connecting rods are simply jointed to the end of the pistons.

Air was readily compressed, states Joule, by this pump, to a pressure of sixteen atmospheres, or 240 pounds per square inch, the quantity passing the sides of the cylinders being very trifling.

This is the earliest reference I have my-

self found to this important principle, which has of late been carried out so neatly in the straight line engine piston and valve rods.

I have seen the principle carried out in modified lines in large water pump buckets, which, to save trouble from sand, have been turned to nice fits in their barrels, and grooved with a number of rectangular grooves, also as though for rings, which were slipped out. The grooves, of course, cause eddies in any film of water escaping by the piston, and at each groove these eddies destroy the onward motion, and there is not time to get through every obstruction during the time occupied in a stroke. It is strange how slowly new ideas are taken up.

Here there is the knowledge published in the headquarters of English engineering that a 10-inch deep piston leaked very little air at 240 pounds pressure, and yet for years practically nothing is done in the direction of utilizing such knowledge.

For rods the principle does not seem to be inconvenient to apply, but for pistons it is possible that a full adaptation of the principle might introduce too great a cumbersomeness. One is inclined, however, to think that for small engines anyhow there need be no clumsiness due to long pistons, further than in the *extra cost* of weight and boring out.

There is no leakage past the oiled solid grooved piston of a good new steam engine indicator, which is only about ¾ inch long.

Though we are accustomed to consider high-pressure steam as possessed of special powers of escape, we should not forget that it is a dense and heavy fluid, and that it is the lighter gases which most easily escape by fine apertures. High-pressure steam need not, therefore, present special terrors for the designer.

We are all acquainted with the method of testing a piston for steam tightness by placing the engine on its dead centers, or for intermediate points in the cylinder, blocking the crosshead, etc., but we should not overlook that a piston or rod constructed on the above principles would show leakage when standing under steam pressure, and yet be perfectly tight as a working part in rapid motion.

The fact that the motion of the piston and rod is opposite to what would facilitate leakage has also much to do with the success of the method, but in Joule's pump, used as an air compressor, air would have a better chance of escape than the steam past a high-speed piston, and present-day speeds seem to warrant a further carrying out of the principle than has yet been attempted.

W. H. Booth.

The Circular Saw Ellipsograph.

Editor American Machinist:

In your issue of March 19th, I think you jumped too quick at Mr. George B. Grant's "Ellipsograph," whatever that may be. The projection of a circular saw at any angle except a right angle with the arbor is an ellipse, but a saw will not cut an elliptical groove in a block of wood, as represented in your cut. I have seen laborers from the yard gang try to do it, so I know it can't be done; and another thing, after they had stopped the saw, it was not unusual to see a bright blue spot, or perhaps more than one, on the side of the saw, and just about that time is not the best time to try to make friends with the man who has to keep the saws in order.

You might be able to cut an elliptical groove as deep as one-half the length of the teeth of the saw, but not in like proportions to those shown in the cut. To make it clear, suppose the saw will cut if the block is fed at an angle of five degrees, then it would cut if the block was fed at an angle of fifteen degrees, and if at fifteen degrees or thirty degrees, why not at ninety degrees, or parallel with the saw arbor? In that case, any one can see that the saw would only make a scratch around with a depth equal to the amount that the teeth projected from the side of the saw by the set of the saw. An elliptical groove could be cut with a side-milling cutter. J. L. D.

[If J. L. D. will call upon us, we shall not only be glad to see him, as we are all our friends, but we will show him a block of wood which accompanied Mr. Grant's sketch, which block of wood has in it parts of two ellipses, as shown by the sketch, and which were cut in the manner shown. By taking enough cuts, a semi-circular groove could be cut by feeding the block at right angles to the saw, or in line with the arbor, and so of any angle. This, of course, was not put forth as a means of cutting large ellipses rapidly, but simply as a means of doing a job not so easily accomplished by other means.]

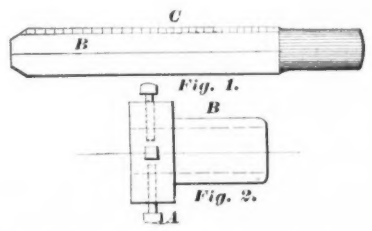


Fig. 1.

Fig. 2.

A Drill Rest for Turret Lathe.

Editor American Machinist:

The article by "A Mechanic," on his leather dog and drill gauge, is very practical. The drill gauge is of especial advantage in grinding flat drills of large sizes to insure sufficient stock to ream, as many a jour. and apprentice has found in practice, and being somewhat interested in flat drill grinding, as to accurate boring, I show a simple method of making flat drills for the turret lathe. Fig. 1 shows the drill, which is fitted to the holes in the turret, and for boring holes of, say $1\frac{7}{8}$", is made of steel $\frac{5}{8}$"x$1\frac{1}{2}$", which is centered and turned to size. A line is drawn on each side at the center, as shown, and the edges laid off in lines $\frac{1}{16}$" or $\frac{1}{8}$" apart, as an assistance in grinding the lips evenly.

This drill then passes through the rest, Fig. 2, which is simply a cast piece turned to fit the rest of the lathe, and having a flange through which is tapped four set-screws, which are adjusted to the drill so it will just pass between their points; this rest being held rigidly just in front of and close to the work, prevents springing of the drill, and insured true work. This being a simple and inexpensive tool to make, I thought it might be appreciated by some of those who have turret lathe work to do. Apprentice.

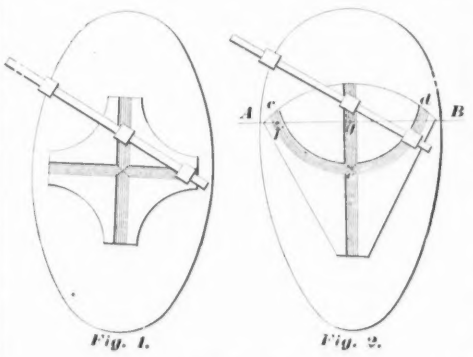


Fig. 1. Fig. 2.

Elliptographs.

Editor American Machinist:

Of the above two sketches, Fig. 1 represents an "Elliptograph" in Webster's Unabridged, under the heading of "Trammel," which certainly is nothing new, but little known among ordinary machinists.

The other, Fig. 2, is a trammel that will scribe an egg-shaped oval, which I have never seen anywhere in print, and which is, as far as I know, original with me.

Thinking that you could throw a little light on the subject for the benefit of your many readers, I give them for what they are or may be worth. Gus. Luck.

[The instrument shown in Fig. 2 we believe to be new; at least we have not seen it illustrated before. For some purposes it may be very useful. The curve in Fig. 2 does not follow any mathematical law. The shape of the oval depends on the kind of arc *c e d* adopted, and since the oval can be any shape to suit the ideas of the designer or the purpose for which it is to be used, it follows that the arc *c e d* may be an arc of a circle or some other curve; but the point *e* of the curve *c e d* in which it intersects the major axis, will always be the center of this axis; and the ordinate *f g*, drawn perpendicular to the major axis, and coinciding with the minor axis *A B*, will be equal to the difference of the length of half the major axis, and half the length of half the minor axis.]

An Industrial University.

Editor American Machinist:

The industrial university of which I write is not an elaborate affair, still it is one which embodies some of the essential features substantially as set forth by Professor Sweet, and is only about thirty miles from the excellent shop of which he is the head.

It happened in this way: Something over a year ago there came to me one day a man who bluntly asked how much I would charge him for one year of instruction in the machinist trade. He told me his age (he was older than myself), and I hesitated. He went on to say that in case he damaged the tools or spoiled any work he would pay me for the same. After meditating upon the subject for a day or two I concluded to take him. (There was not much work in the shop, times were bad, and I was not employing the usual number of men.) I told him I would offset my time against his, or, in other words, would charge him nothing.

I own that I did feel a little bit ashamed of myself, and tried to keep it still, as it is something unusual for apprentices to work for nothing, and board themselves, but it soon leaked out, and another young man came into the shop one day and wanted to learn the machinist trade. I told him upon what terms he might come (which were the same as in the other case) He said he would have to go and earn a suit of clothes, then he would come. I never expected to see him again, so imagine my surprise to see him come one morning, dinner-bucket and overalls, and ask to be set at work.

I now have five working, and I expect two more very shortly. They are taken for one year only. As yet it is an experiment, being in its infancy.

We devote one evening each week to drawing, and the boys are all on hand Wednesday evening for their "lesson."

The work is such as is done in ordinary country machine shops, together with a class of machine tool work requiring excellent workmanship.

We have some unwritten laws, which are, however, understood. First, no work goes out of the shop which is not just as good as it can be made; second, time is not taken into account in doing a job until it is thoroughly understood, and not then at a sacrifice of workmanship.

As to the quality of the work done by the "boys" (they are all over twenty-one), perhaps Professor Sweet might be able to say something about that, as he has seen some which was done by a boy of less than one year's experience in the machine shop.

As to the price of work done, it is charged for at its face value, and not by the hour.

The professor's plan of "the whole shop a tool-room, and every boy a tool-room boy," is not entirely new to us, as about three months ago we tore down our tool-room partition to make more room, and find that the tools are more often returned now to their racks than they were when it took from two to five trips the length of the shop to put a half-inch set-screw in a pulley.

Perhaps my little experiment will never pay me in dollars and cents, but if I can lead some of the young men around some of the sloughs that I got mired in when I was younger, and have them look back upon me with gratitude, which, I am sorry to say, I cannot do to the man who steered me through my first two years of machinistry, then my labor will not have been in vain.

Homer, N. Y. J. A. Gilkerson.

Direct or Indirect Connection of Main Line Shaft to Engine.

Editor American Machinist:

In answer to J. T. Mowrer, as to which will give the best results, direct or indirect connection of the main line shaft of a mill to the engine, I think that where it is convenient to have the main line of shafting in line with the engine shaft, as it appears to be in his case, a direct connection with a coupling is to be preferred, for various reasons. There would scarcely be more than one reason for belt connection in his case, and that would be in removing the belt to stop the line shaft without stopping the engine, and in this case it would not be necessary, unless the engine had other than this line to pull.

I will mention what I think are some of the advantages of a direct connection by coupling, over that of a belt connection. There is one belt less to care for; from two to four bearings less to look after and oil; no loss of speed in the main line by the slipping of the belt; a coupling is cheaper than a belt, and there is no need of the wheels that a belt will call for. S. A. Smith.

I notice in your issue of March 19 the article, "Wants an Opinion." Now, in regard to coupling line shaft of mill to engine shaft, I claim it is not a good plan, although there are many reputable mill builders that do it. I have been running engines in different flour-mills for the past seven years, and I have always noticed, in cases where line shafts were coupled to engine shaft, that it was more difficult to keep the engine running smooth and nice than where the line shaft was driven with a belt, for if there is any sudden jar or shock along the line (in case of coupling to engine shaft), it is transmitted to the engine direct; and should the engine be worked hard, it will tell on her before the week's run is out. I have heard men claim that it gave an advantage on power to couple direct, and I know that the E. P. Allis Company build a great many mills on that plan. You see, I only favor the belt from an engineer's standpoint, believing that it is easier on the engine, and I am just like Mr. Mowrer—I would like to have some light on the subject. J. L. Adkinson.

The Schiele Curve.

Editor American Machinist:

Your correspondent Mr. J. Richards, in issue of March 26, accuses me of writing "flippantly" regarding the Schiele curve. I do not know the meaning of the word "flippantly," unless it is *lacking seriousness;* and I did not think the occasion merited very serious treatment.

Mr. Richards also brings out the word "opinion," and puts it to my credit. That is a word I never use in writing for the American Machinist. I always give facts, and I think Mr. Richards, if he will look over the articles again, will find them to coincide with his own experience. He may also notice that I spoke of only one mill in the Boston shop as having the magic curve; the other one has straight lines. I was also careful not to make any comparison between the two, as it was not boring-mills that I was writing about.

Mr. Richards says, referring to the Schiele bearing, that it does not appear from my letters that I have had any experience in bearings of that kind. That was merely because I did not wish to load the record with unnecessary talk. My experience has been much the same as that of other men who have run machine shops. I have been a part owner, and am yet, in several boring-mills constructed upon the Schiele curve theory. Their action leaves nothing to be desired; but these, with their enormous bearing surfaces, four or five feet diameter, and low pressures, and slow speeds, are not comparable with bearings carrying a high pressure per square inch with 100 or 200 revolutions per minute. I have never made and never wish to make one in that way. Mr. Lane has made one, and we all hope he will report from time to time on its performance and cost. Mr. Richards says, "They are expensive to make, and not necessary for ordinary duty."

As to the shafts of marine propellers, it seems to me wandering into a subject that I do not know much about. But I would be pleased, and I presume your other readers would be pleased to have a few figures and

facts, and an illustration of the Schiele curve as applied on these shafts.

As to rotary engines, if the Schiele curve would make them a success it seems curious that the patent of Christian Schiele of 1855—rotary engine—should have laid buried all these years.

If Mr. Richards will kindly explain what he means by "radial faces," I may, perhaps, be able to tell him whether or not I know anything about them.

WILLIAM H. HARRISON.

The Catalogue Question.

Editor American Machinist:

It is probable that this catalogue question has bothered a good many people besides Chordal. We have tried for several years the pasteboard box system, classifying them into machine tools, engine boilers, etc., but the result has not been entirely satisfactory. When a box was full, or nearly so, it was a nuisance to hunt over the pile, and when more than full, another classification was necessary, and another trouble was, it put all size catalogues together. Besides this, it was necessary to start with a number of boxes, which took up a lot more room than was necessary.

Our assistant secretary, Mr. Thomas, has devised what appears, so far, to be a much better scheme. A set of envelopes about 7x10 inches is used, and numbered from one up; every tenth envelope has a projecting tag about three-quarters of an inch big, projecting out with its number, so that, when the envelopes are placed upon a shelf edgewise, in their proper order, any one can be found at once, and restored to its proper place, without disturbing any other one. When a catalogue is received that it is desirable to preserve, it is indexed, given the next number, put in an envelope, and deposited in its proper place. It matters not how small the catalogue is, or whether more than one from the same concern. If the envelope will hold them all, they all go in; if not, use another number, and put the numbers opposite the name in the index. A second index with the subjects classified would cover all the advantage of having the catalogues in boxes according to the subject matter. We, however, find for our use the single index sufficient.

A very large proportion of the catalogues we have received might as well have been 6x9 (the size sugested by Mr. Sanders) as well as what they are, and so we have taken steps to have a new edition of our own catalogue made that size, even though some cuts will have to be made anew.

If any considerable number of tool builders, etc., could be induced to adopt the 6x9 inch size, and call it standard size, let it be understood that special pains would be taken to preserve standard size catalogues, and quite a move would be made in a rather desirable direction.

What we do, with those too large, unless of direct value, is to throw them aside.

JOHN E. SWEET.

Teaching Trades in Reformatories.

Editor American Machinist:

In order to treat this subject understandingly it is necessary to take into consideration various social features, and to know something of the science of penology. It is, however, very easy to give opinions, and to present plausible schemes that appear to be full of promise, but which upon trial will be found to be Utopian. It is also very easy to condemn methods of policy and detail, but not easy to devise new ones that will be successful. After looking into the subject it will be found to broaden, and on investigation one will be brought face to face with vital problems that he had never thought of before in that connection.

Men do and will commit crimes; society must and will put into operation means designed to punish offenders, and to protect itself from the depredations of such as may be convicted. Various communities differ largely in the severity of the methods they employ to these ends, and the results achieved, other than a definite period of restraint, have not in the past been of a character to inspire hope of reform, unless the person at his release has the means of earning his own living, and taking his place in the ordinary walks of life.

There is one thing, however, that may be put down as a fact, and this is that mere punishment, or the fear of it, does not deter men from committing crime. In countries where even death is the penalty for theft, there are still thieves, and in States where the punishments and discipline are most severe, men still become confirmed felons, and repeatedly convicted. It must then be admitted that prisons will always exist, and that they must be maintained as public institutions, their object being, first to safely confine those convicted, and secondly to provide for the employmant of such. The first object—confinement—implies and makes necessary various restrictions as to the character of the work they may be employed at. First there must be ample arrangements for the internal and domestic care and maintenance of the institution, and secondly such industries may be carried on as are found to be available or expedient, provided so many are not employed in any one branch as to interfere with the same industry outside.

Now let us see who prisoners are. Upon close examination it will be found that, while there are many subdivisions, they can quite easily be divided into two classes, viz., incidental and habitual criminals. In regard to the latter, it is probable that the future student of political economy will wonder at the fact that the people of the present time allowed criminals of known vicious intent to practice their depredations with only periodical confinement; for before many years it is to be hoped that the system of identification of criminals by scientific mechanical measurement will have become universally adopted, and it will become impossible for a person to be repeatedly convicted without the whole facts of his criminal history being known.

As to incidental criminals, they include all classes of persons, and crimes from capital cases to petty larceny, and such offenders might often be allowed their freedom with very little danger of their again committing crime. In studying statistics of crime it is found that of those convicted for the first time, very few have any trade or settled occupation, and it may therefore be fairly presumed that the possession of a trade is a safeguard against many temptations that are incident to the want or lack of employment.

If you visit a reformatory as generally established, you will find several hundred young men between the ages of sixteen and thirty, who, to the best belief of the judges that passed upon their guilt, are fair subjects for reform. The future prospects of these men, and the probabilities of their becoming respectable citizens, or lapsing again into crime, must be of vital importance to the community in which they are to mingle. Is it not better that they should have an opportunity to acquire some trade or occupation that will enable them to gain a living when released, so that they may be self-supporting instead of being almost obliged to again become offenders, and eventually habitual criminals? It should be remembered that the way is short and easy from incidental to habitual criminality, and that it is better for a community to have a person do his part in life, than to be obliged to support him in prison.

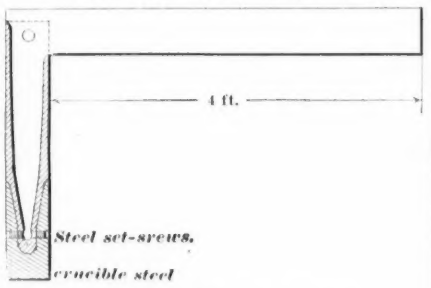
As to the disgrace to any trade, the lowering of the dignity of an occupation, because of the fact that such trade may be taught in prison, there is doubt if it can be borne out by actual test. To admit of such disgrace, it must be premised that the public or employers would suspect that applicants for work, if of trades taught in prison, were graduates of such schools, and would want proof to the contrary before hiring them; or else it is supposed that the public at large would become suspicious of mechanics generally, believing them to be only thieves in disguise. Is it not more in reason for each man to make a record for himself, and to honor his craft by good work and reputable conduct, than to fear suspicion for the possible misdeeds of others? When we hear of a crime committed by a machinist or a carpenter, we do not condemn the occupation, but rather the individual man.

Penology bristles with analogies, and while there may be found behind the prison bars many excellent mechanics and men with various other attainments, yet the fact remains that a large proportion of felons have no trades. If you descend the scale from felons to misdemeanants, you may find a larger proportion of mechanics, who have become wrecks on the rocks of intemperance, for rum is no respecter of rank or condition, and the mechanic keeps step towards the potter's field, between the lawyers and the clergymen.

The action of a State in putting the means of gaining an honest livelihood within reach of its first offenders, is often unfavorably compared with the non-action of the same authority in not providing means whereby those who have not committed offenses may be benefited. While being in favor of trade schools and manual training for children, I should rather have a boy gain his trade in some regular way, and largely by his own exertions, than to have him gain it in any State-assisted institution. But be that as it may, the policy of a State, or its duty to offenders, should be settled independently of its duty to law-abiding citizens, who should be thankful that they are not wards of a commonwealth. It is as if a well person should complain of his poor diet in comparison to the delicacies and care a hospital patient may receive; for in each case the treatment is enforced, and avowedly for the person's good.

B.

Cast-steel hardened & ground.



An Adjustable Try Square.

Editor American Machinist:

Perhaps some of your readers may find the following method of making a large steel square suitable for a shop standard, or for general shop use, of value. The principal advantage of this method of making it consists in it being adjustable after being hardened and ground to standard straight edges, and in being able to make it standard again, should it accidentally become slightly injured, as most of them do sooner or later.

FRED. W. SALMAN.

The Schiele Step Bearing.

Editor American Machinist:

I have been interested in the discussion regarding the Schiele step bearing. I have had no practical experience with the Schiele bearing, but in my experience with plain-faced thrust bearings I have found that, where the shaft itself takes the thrust on the end, it gives better results regarding friction and wearing qualities than on a collar on the shaft. Speed of bearing surface probably accounts for this.

Take screw presses as another example; thicker metal can be punched with one having the end of screw act as a thrust than with one with collar bearings, other things being equal. The collar absorbs too much power.

Taking these facts into consideration, it appears that the center of the bearings is the very best part of it. This order of things is reversed in the Schiele bearing. The center is made of such a shape that it may wear away faster, and is virtually thrown away.

These arguments apply to the Schiele curve as a thrust bearing only. Boring mills require a bearing to steady as well as support the end on the spindle.

Judging from the vigor with which Mr. Richards has tackled Mr. Harrison, he (Mr. R.) must be withholding some very interesting facts and experiments relating to the Schiele bearing. I hope he will give us some detailed facts regarding the matter.

FRED A. WELLES.

Mechanics and Specialists.

Editor American Machinist:

I have been very much interested in Mr. W. S. Rogers' "Sketches of an Apprenticeship," and the many improvised methods which "Tom" has made use of has set me to thinking as to what I should have done under similar circumstances, and altogether I have learned many things which may be of use to me in the future.

There are one or two things in the issue of March 19th, however, about which I would like to say a few words.

Mr. Rogers claims that a boy becomes "expert" on a planer, shaper or lathe in six months. To my mind an expert planer, for instance, is one who can do any job that is set before him. Now, I should like to see the boy who, after running a planer six months, would undertake to plane up one of the many pieces of accurate work which is required in a first-class shop, and make a good job of it. Perhaps there are such boys (they must surely be born mechanics), but I have yet to find them.

I am employed in a machine shop in which there are employed about 500 machinists, the majority of whom have served their apprenticeship (which consists of six or eight months on each machine tool, including lathe, planer, shaper and slotter, and the remainder of their time is given to vise work) in this shop; an apprenticeship of five years is required. They are also given instruction in mathematics and mechanical drawing, so, you see, the boys are given an opportunity to bring out whatever good there is in them.

But, to the point: I will venture to say that of the 500 machinists there are not more than 5 per cent. who are capable of doing the work required on our planing machines.

It seems to me that this is a day of specialties; an ordinary man cannot be expert in everything in the machine shop. He may be a first-class vise hand; he may be able to construct a machine, and yet be incapable of running it.

Since this state of affairs exists, it seems to me that a boy must put in more than six months on a machine in order to become "expert," and in order to take the place of one who has had years of experience, and who has found that even he has many things to learn.

CHARLES STELZLE.

How Shall He Make His Tool Chest?

Editor American Machinist:

During the several years which it has been my privilege to read the AMERICAN MACHINIST, I do not remember reading a single article relating to the construction of tool chests. Now, as I am about to have one made, and as those I have seen were constructed just as "so and so" made his—which was generally a very poorly arranged affair, without any effort to rectify current defects—it occurred to me a word in the AMERICAN MACHINIST would call forth something concerning the subject, which would interest others as well as myself. The exact plan of gaining access to the various tools one uses in the shop is a small matter; but what we want is a *place* to hoard the same, so when we want a certain tool it will be forthcoming, without unnecessary delay.

L. W. FRANKLIN.

Our enterprising contemporary, the *Colorado Exchange Journal*, has issued a special number devoted to Texas and its industries. It is large in dimensions, contains a variety of illustrations of scenes and scenery, buildings, etc., in that State, and a large number of carefully prepared articles on Texas industries, its cities and manufacturing advantages. The price of this number is $1. The *Exchange Journal* is published at Denver, Col.

The *Mechanical News* has been changed in form, the size of the pages being reduced, while their number is increased. It is very much improved in appearance.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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The Tragedy in the Coke Regions.

The tragedy that has recently been enacted in the coke regions of Pennsylvania points out a lesson the country cannot afford to let pass unheeded. It was a tragedy in which ignorant laborers attacking property find their number lessened by the deadly Winchester rifle in the hands of "deputies." There is little doubt that the coke workers intended to destroy the property of the company, and the company, naturally enough, proposed to defend it. If this was all there is of the matter, but little need be said. It is not to be expected that men will stand idly by and see their property destroyed by a mob when they have the ability to prevent it, even though some one gets hurt.

But this is not all there is of the matter. These men who started out to do the most illogical thing in the world—destroy property because they could not gain the points in dispute between themselves and the coke company—were men who never should have been permitted to land in this country. Many of them, beyond any doubt, were men who, at one time or another, had been imported—perhaps not by the company whose property they attempted to destroy, but by other large companies, in some instances in spite of the prohibition of a law never intended to seriously prohibit; imported, because they would work cheap, to take the places of other men who would not work so cheap. Others of them came under the false allurements of the agents of the steamship companies, and still others for different but pressing reasons. They were principally men who had no intention of becoming citizens of the United States, and who should never be permitted to become citizens. They were brought to this country very much as cattle and sheep would be brought, if the bringing of cattle and sheep was profitable. Their habits of life had been such that they could live on the refuse of self-respecting workmen, and it was apparently believed that the density of their ignorance was such that they would go right along working for small wages, because it was more than they had ever received before. But experience has demonstrated, time and again, that such men will not continue to work for small wages. They can be depended upon to learn, very quickly, that they are working for less than current rates, and to demand somewhere near these rates. With this trait in their character, no one except those immediately affected by it is likely to find fault; it is commendable. It is the methods employed in the endeavors to compass their ends that interest the people at large. It is something that concerns not alone or principally the coke producers and their workmen. It is something that concerns every citizen, and something in which every citizen has a right to be concerned.

In any light in which the matter may be viewed, no company or individual should be permitted, directly or indirectly, to import or connive at the importation of such men, and no steamship company should be permitted to land them. They are in no sense representative of the countries from which they come; they are men whom these countries are exceedingly pleased to get rid of; men without any ideas whatever of governing or being governed, except by brute force; men who know nothing of the language or institutions of this country, and who have no desire to know anything of them; men to whom fairly civilized methods are repugnant. They are as far removed from the decent, self-respecting emigrants who come to this country understanding what law and order is; come here in the hope of bettering their condition, expecting to live under the laws of the land, and eventually to help to make these laws; as far removed from such men as it is possible to conceive.

It may be—though in the end we doubt it—possible for some large companies in Pennsylvania, and elsewhere, to make money by the employment of such labor, but the country at large is losing enormously by the introduction of an element so dangerous and so entirely antagonistic to its institutions.

But good may yet come from this Pennsylvania tragedy if it stirs up the people to bring such a pressure to bear upon those who make, and those who execute the laws, as to put a stop to the landing in this country of emigrants of the character of those who have brought disgrace upon it.

Without saying anything of the immediate wrong done intelligent workingmen by the influx of men too ignorant to know anything of law and order, and too degraded in their habits to live decently, the ultimate effect upon the country of such an influx ought to be apparent enough to induce legislation so stringent as at once to prevent importation of undesirable workmen under contract, and to prevent the steamship companies from landing a class of men whom the country connot afford to harbor at any price. Intelligent emigrants, men who come with a sense of responsibility, will meet all the just requirements of the country, and no others should be permitted to come. The citizens of this country—born and naturalized—have rights, one of which is self-preservation.

Small Compound Engines.

Scarcely more than ten years ago (November, 1880,) President Thurston, in the discussion of his inaugural address before the American Society of Mechanical Engineers, in reply to a query as to the relative economy of simple cylinder and compound engines, (condensing) after making other statements, said: "Sometimes one engine comes out a little ahead and sometimes the other" (referring to the two types mentioned). Since then, however, advances in the art of making and handling compound engines have settled the superior economy of the latter beyond any reasonable question; that is, very few, if any, engineers doubt that there is a very important saving in compounding engines of one hundred horse-power and over. The prejudice against compounding in such cases has, in this country at least, been overcome mainly by the logic of facts, as we have said before this.

As an instance somewhat to the point, the writer remembers about twelve years ago having to do with a compound engine in the way of testing for economy and general adaptability to the purpose for which it was designed. At the time the observations were being made, a well-known builder of high grade steam engines came into the engine-room, and, after critically observing the behavior of the engine, expressed himself very freely to the effect that, after careful observation and consideration of the whole subject, his conclusions were that, on the point of economy alone, the compound as a mill engine could never compete with the simple cylinder engine. Since then, however, he has come to be a strong advocate of compounding, recommending such engines for nearly every purpose where more than one hundred horse-power is required.

But while the economy of compounding in the instance of large and moderate-sized engines is so universally conceded, the ground for this economy is not so apparent that engineers do not disagree about it. One reason for this is, perhaps, the attempt to account for it in one direction, while the economy is doubtless affected by various causes, some of which are not very apparent.

But while there has come to be a general willingness to admit the value of compounding engines of one hundred horse-power and over, it has been rather strenuously held that for small engines—say from twenty-five horse-power up to fifty—there was no gain in compounding. Such engines will naturally be operated non-condensing, and it has been argued that there would be loss rather than gain in their use. But this is not a settled fact. When it is seen that such engines can be built without serious complication of parts, prejudice will to that extent be disarmed, and instead of here and there a small compound engine being built, it may be found that there is a promising field in that direction.

If it is finally demonstrated that the compound locomotive is superior in point of economy to the non-compound, an impulse is likely to be given to building non-condensing compounds for stationary purposes, that may speedily reach the smaller sizes.

Literary Notes.

ODONTICS; OR THE THEORY AND PRACTICE OF THE TEETH OF GEARS. By George B. Grant

This, the latest work on gearing, is a publication, in book form, of the articles which have recently been concluded in our columns. Our opinion of the value of the matter has been expressed in our issue of Dec. 25, '90. We know that the articles, as published in the papers, found a large number of readers among the practical mechanics of the country, upon whom the general excellence of the gearing used finally depends, and in the convenient form in which it is now published it should find a place in every mechanic's library. Useful as it is, however, it would be much more so if it had an index. We think no work on such a subject, nor, in fact, upon any mechanical subject, should be published without being thoroughly indexed. Their convenient use as books of reference makes it necessary, and the greatest use of most books on mechanics and technical subjects is as books of reference. Nevertheless, this is a valuable book, and at the first reading one can make his own index, if he chooses, for future convenience. It is published by the Lexington Gear Works, Lexington, Mass. Its price is $1.50, postpaid.

THE SOURCE AND NATURE OF ELECTRICITY AND ITS APPLICATION TO ELECTRO-PLATING PROCESS. By Scott A. Smith, Member of the American Society of Mechanical Engineers.

This little book of 35 pages has been issued by the Gorham Manufacturing Co. (silversmiths), Providence, R. I. In the introduction, which is the larger part of the book, an attempt is made to tell what electricity is, and the old theory, that electricity is a substance, is revived. The treatment of the subjects is an admirable example of condensed statements, and to appreciate the book requires in the reader a knowledge of electricity, yet any one may profit greatly by its perusal and study. The book is gotten up in a very tasteful manner, and is in a line with the artistic work of the Gorham Manufacturing Co.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(170) J. F., Cleveland, Ohio, asks: Which is the better material to use for a one horse-power boiler, copper or iron? *A.*—We prefer iron.

(171) L. P. H., Wilmington, Del., writes: A shopmate and I have had an argument relating to solid-ended side rods. Do the brass bushings add anything to the strength of the rod? *A.*—No.

(172) Reader, Brooklyn, N. Y., writes: I have a lot of small castings of gun metal iron, in which I find trouble in working. Some I find soft enough and others very brittle. Can you tell me of any way that I can anneal them? *A.*—The annealing process will depend much on the shape and size of castings, and the mixture of the metal; and in many cases trials will be necessary to determine the course to pursue. We should heat the castings in a charcoal fire to the proper temperature, which can only be determined by experience (probably to a cherry red), and then cover the pieces and the fire with pieces of plate-iron, and again cover the whole with cinder ashes, and allow the fire to go out of its own accord.

(173) E. W., Grand Rapids, Mich., writes: What books can you recommend for reference and study to a molder of several years' experience in the shop? I want something for reference, both for molding cast-iron and brass. Recommend the book which you consider to be the best in print. *A.*—There are many good books published treating on the above subjects, each covering a particular

field, according to the author's experience, and therefore it is a difficult matter to say which is the best, and which of these will be most suitable for you. In fact, for reference you will need more than one book. We should advise you to get a catalogue of technical works, or, if there is a public library in your locality, examine there the books relating to these subjects, and make such selections as your experience in molding may suggest as the best for your purpose.

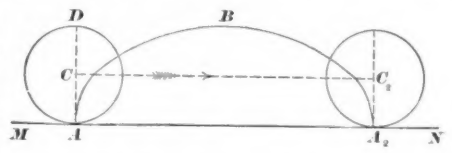
(174) C. D., Sudbury, Canada, asks: Would there be as much economy in using steam expansively in a direct-acting pump as in other engines? I am told they require steam the entire length of stroke. I know of pumps that work all right with 60 pounds of steam pressure, while the regular pressure is supposed to be 110 pounds. I claim that there will be economy in cutting off the steam at half stroke. *A.*—In pumping water against a constant head, the steam in the cylinders should also develop a constant power. Hence, in direct-acting pumps which have no fly wheel, the steam should follow full stroke. In fly wheel pumps, the steam may be cut off and expanded; the fly wheel will regulate the power developed, so as to make the work uniform. This is the only office of the fly wheel, and if some other device which is less costly, simpler, and more effective, is substituted for the fly wheel, there will be a gain by expanding the steam.

(175) Mariner, Sitka, Alaska, writes: In a manual of marine engineering occurs the following statement, which I think is incorrect, namely: "The friction of the water per square foot of surface will depend upon the pressure directly, so that the resistance from a square foot near the water line is very different from one twenty feet below it." Other authorities, which I do not happen to have at hand, enunciate the law that fluid friction is independent of the pressure. *A.*—The opinion that the pressure varies with the depth of flotation is frequently entertained, but nevertheless we believe it to be erroneous. The amount of resistance to friction for a given extent of rubbing surface is by experiment found: 1. To be independent of the pressure between the liquid and the solid; 2. To vary nearly with the square of the relative velocity; 3. To vary directly with the amount of rubbing surface; 4. To vary directly with the heaviness of the liquid, that is to say, the weight of a cubic unit of the liquid.

(176) J. W. S., Phœnixville, Pa., writes: Please inform me through your columns, what should be the speed of a Judson governor to fully control a horizontal engine 18x36 inches, making 60 revolutions per minute with 60 pounds steam pressure; and please state how I can set the governor to the right speed. *A.*—There are two kinds of Judson's governors manufactured, the standard and the spring governors; the standard is run at a slower speed than the spring governor, and the speed at which they should be run is stamped on them. For your engine the speed of the standard governor will probably be 115, and that of the spring governor 165. In order to set these governors to make this speed you will have to put the proper size of pulley on the shaft. Or give the diameter of your pulley on the main shaft to the manufacturers of the governors, and they will put a suitable pulley on the governor. 2. What should be the power of the engine under the above conditions? *A.*—We should rate it at 83 indicated horse-power.

(177) Reader, Brooklyn, N. Y., writes: I am apprenticed in a printing press building shop, and I wish to become a marine engineer. I do not care to leave this shop and go into a marine shop, as I think that I can learn the machinist trade where I am engaged at present. I study in the evenings, and take lessons in mechanical drawing also. Please give me your advice, and refer me to good books, which will enable me to succeed in becoming a marine engineer? *A.*—You have commenced well; continue your study in the evenings, and learn as much of mechanical drawing as possible. The marine engineer's duties have increased much in late years, and to be successful, it is necessary that he should have a good knowledge of the different branches of mathematics. We should therefore advise you to follow the course of instructions indicated in our issue of February 19, current volume. All the books we have mentioned there are good books, and they are serviceable in many branches in which an artisan may be engaged, and particularly in the engineering profession. After you have mastered the elementary studies mentioned in our article, and with which all marine engineers should be familiar, you will have a sufficient knowledge to enable you to decide, without any assistance, which of the more advanced works will be of the greatest benefit to you, and to which the greatest amount of time should be devoted. You will also then be in a position to decide whether it will be of advantage to you to work a year or so in a marine engineering establishment, so as to obtain an experience in marine engine building, and a familiarity with marine work, which in our opinion is essential.

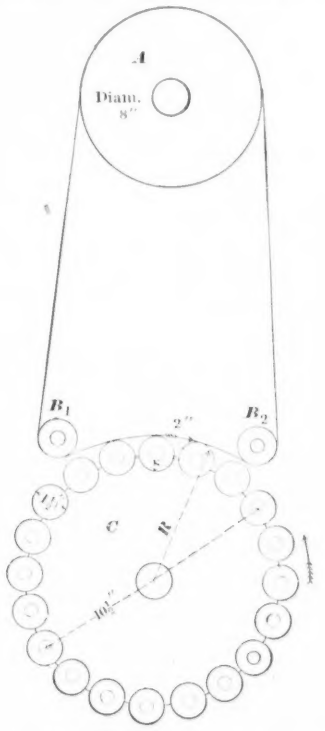
(178) W. L. E., Rock Falls, Ill., asks: How much further will a point on the circumference of a driving wheel of a locomotive move while the wheel makes one revolution upon the rail, than the center of the wheel? The wheel is 4 feet 6 inches diameter. 2. Will a point on the circumference of a wheel move further while the wheel makes one revolution upon a straight surface than a point upon the circumference of



a wheel which makes one revolution upon its axis? *A.*—Let *A D* be the wheel moving along the track *M N* in the direction indicated by the arrow, and let *A* be a point on the circumference. The path of this point during one revolution of the wheel is represented by the curve *A B* A_2, which is a cycloid. The length of this curve is equal to four times the diameter of the wheel. If the wheel is 4.5 feet in diameter, the length of the cycloid will be $4.5 \times 4 = 18$ feet, hence during one revolution of the wheel the point *A* travels through a distance of 18 feet. The path of the center *C* of the wheel is represented by the straight line *C* C_2, and for one revolution of the wheel, the length of *C* C_2 will be equal to the circumference of the wheel, which is equal to the product of the diameter of the wheel into 3.1416. If then the wheel is 4.5 feet diameter the center *C* will travel, during one revolution of the wheel, through a distance of $4.5 \times 3.1416 = 14.1372$ feet. We have found that during the same time the point *A* will travel through a distance of 18 feet, which is $18 - 14.1372 = 3.8628$ feet greater than the distance through which the center *C* has traveled. In regard to the second question, it will be readily seen that during one revolution of the wheel on its own axis the point *A* must travel through a distance equal to the circumference of the wheel, which, as we have already seen, is 3.8628 feet less than the distance through which *A* travels during one revolution of the wheel along the line *M N*.

(179) D. E. P., Allegheny City, Pa., asks: What is the duty of an engineer in regard to blowing out his boiler? *A.*—Many of the impurities of water will sink to the bottom of the boiler, and to remove these impurities the bottom blow-off valve is used. The common practice is to blow down a little two or three times a day, with a boiler at work; but in some cases it may be advantageous to blow down oftener. Sometimes the impurities are held in suspension for some time by the agitation of the water after they cease to be soluble, and float as a scum on the surface; in such cases a surface blow-off valve is often used. Again, when the water contains impurities of light weight it is found better to blow down after the boiler has been for some length of time quiet, and the deposit has had time to settle. From the foregoing, it will be seen that it is the duty of the engineer to observe closely the kind of water he is using, and the effect produced by blowing down, and then use the blow-off valves at such times, and with such intelligence, as will keep the boiler clean with as little waste as possible. 2. Is the effect of the pressure exerted on the internal surface of a cylinder the same as that of the pressure on the external surface? *A.*—No. If the cylinder should not be exactly true, the effect of the internal pressure will be first to produce a true cylindrical surface, and then tear the metal apart. With an external pressure, the effect will be, if the cylinder is not exactly true, to flatten the cylinder still more, and cause it to collapse with less pressure than it will require to burst it. Generally, cylinders will not stand as much external pressure as internal pressure, and often the difference in these pressures is considerable.

(180) C. W. B., Toronto, Canada, writes: I enclose a sketch with a description and a query to which an answer in your columns will greatly oblige me. *A* is a pulley carrying a round belt over idler pulleys B_1 and B_2; *C* is a disk with a number of small pulleys on spindles around it, which engage with the belt as they pass between the idlers B_1 and B_2. The diameter of the pulley *A* is 8 inches, and the diameter of the disk is $10\frac{1}{2}$ inches on the line of centers of the small pulleys on spindles; these pulleys are $1\frac{1}{2}$ inch diameter. The disk revolves at a speed of 20 revolutions per minute in the direction of the arrow on sketch. What I wish to know is at what speed shall I run the pulley *A* to turn each of the $1\frac{1}{2}$-inch pulleys on the disk three revolutions per minute while its center passes through a distance of $3\frac{1}{2}$ inches? Please explain how to compute the speed of the pulley *A*. *A.*—Assume that the belt on the idlers is stationary, and that the disk makes 20 revolutions per minute, now let us find, under these conditions, the number of revolutions per minute of the small $1\frac{1}{2}$-inch pulleys. The speed of these pulleys is as much greater than that of the disk as the radius *R* of the belt is greater than the radius *r* of the small pulleys. The radius *R* is equal to six inches, and the radius $r = \frac{3}{4}$ inch, or in decimals .75 inch, consequently during one revolution of the disk the small pulleys will make $\frac{6}{.75} = 8$ revolutions; and the number of revolutions per minute will be $8 \times 20 = 160$. According to the original conditions the $1\frac{1}{2}$-inch pulley is to make three revolutions while its center passes through a distance of $3\frac{1}{2}$ inches. The diameter of the disk on the line of centers is $10\frac{1}{2}$ inches, and its circumference on the line of centers is 32.98 inches. This circumference contains the distance of $3\frac{1}{2}$ inches, through which the small pulley has to move in making three revolutions, $\frac{32.98}{3.5} = 9.4228$ times, and, consequently, during one revolution of the disk the small pulley must make $9.4228 \times 3 = 28.2684$ turns, and during 20 revolutions of the disk it makes $28.2684 \times 20 = 565.368$ turns. But we have seen that when the belt is stationary the small pulley will make only 160 turns for 20 revolutions of the disk; here, then, we have a difference of $565.368 - 160 = 405.368$ revolutions per minute for the



small pulleys which must be made up by the speed of the belt moving in the direction as indicated by the arrow 2. The circumference of $1\frac{1}{2}$-inch pulley is 4.712 inches, hence the speed of the belt must be $4.712 \times 405.368 = 1{,}910.094$ inches per minute. The circumference of the 8-inch pulley is 25.13 inches, and the speed of the circumference we have found to be 1,910.094 inches, hence the 8-inch pulley must make $\frac{1{,}910.094}{25.13} = 76$ revolutions per minute.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gears, gears, gears, gears, gears. See page 20.

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Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

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Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Ice and Refrigerating Machines, 155 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N. Y.

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Special Tools for Railway Repair Shops. Pedrick & Ayer, Philadelphia, Pa.

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I. D. L. Drawing Stands. The original. For particulars and prices, address W. S. Rogers, Troy, N. Y.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Miller's Falls Co., 93 Reade st., New York, are building a Power Frame for their Star Hack Saw.

S. A. Smith, 23 So. Canal st., Chicago, Ill., agent for Appleton Mfg. Co.'s Emery Grinding Machinery.

Special designs and drawings made by Arthur L. Stevens, Mech. Eng., 11 S. 9th st., Phila., Pa.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 350 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

"Twenty Years With the Indicator," by Thos. Pray, Jr., 9,500 sold. Price $2.50. Order of bookseller, take no other.

Audubon Machine Works, New Haven, Conn. Electrical work, superior facilities, builders of machinery, heavy and light.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

Most sensitive and durable Damper Regulator made; works within one pound; send for circular. T. Kieley, 11 W. 13th st., New York.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

Self-adjusting Hand-screw for pattern makers, cabinet makers and wood workers generally; send for circular. Wm. H. Denney, Lancaster, Pa.

"It is simply a splendid work, I assure you," is said of "Hawkins' Calculations for Engineers, Firemen and Machinists," by C. E. Canfield, Providence, R. I. 10 parts, 25 cents each; bound, $2.50. Theo. Audel & Co., 91 Liberty st., Pubs. Catalogue.

25" / 32" / 37" / 42" — "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

DuBois & DuBois, Patent Attys, 715 11th St., Washington, D. C., procure first-class patents. Send stamp for illustrated pamphlet, "March of Invention," containing valuable information, and list of references.

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D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

Foot and Power Presses for Metal, Paper and Leather; perforating dies a specialty; estimates given for special Machines or Dies. Edwin B. Stimpson & Son, Manufacturers, 31 Spruce st., New York.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations. 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt St., New York

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

The Atlanta (Ga.) Car Company may enlarge its car works.

A cotton factory will probably be located at Chattahoochee, Ga.

A large steel plant will probably be erected at South Bristol, Tenn.

The capacity of the Scotland Neck (N. C.) Cotton-mills will be doubled.

There is a probability of bridge works being established in Austin, Tex.

A 5,000-spindle cotton mill is reported as to be established at Halifax C. H., Va.

It is reported that J. H. Krause will start a brass and iron foundry at Tampa, Fla.

Large iron and steel works may be established at West Newton, Pa., by J. W. Baily.

A rolling mill and cotton tie factory are reported as to be erected at Sylacauga, Ala.

The $100,000 rolling-mill now building at Anniston, Ala., will soon be in operation.

A company is being organized at Canton, Ga., to erect and operate a cotton factory.

The Lone Star Planing-mill Company, Ft. Worth, Texas, will enlarge its planing-mill.

A company will establish, it is reported, an iron foundry and machine shop at Orange, Tex.

A proposition has been made by out-of-town parties to erect a woolen-mill at Sherman, Tex.

The Elliston Machine Works Co. have established a foundry and machine shop at Elliston, Va.

The Harrisburg Boiler and Manufacturing Works, at East Harrisburg, Pa., will increase capacity.

A Canada party is investigating with a view to the establishment of tool works in Atlanta, Ga.

Arrangements are, it is reported, being made for the construction of a rolling-mill at Cedartown, Ga.

The Birmingham (Ala.) Boiler Works, Crellin & Nalls, proprietors, has doubled the capacity of its plant.

The Grand Trunk Railway will establish a rolling-mill at Point St. Charles, Quebec, to cost $50,000.

It is stated that the Martin's Ferry (Ohio) Boiler Company will remove their works to Cameron, W. Va.

Endeavors are being made for the organization of a stock company to erect a cotton-mill at Thomaston, Ga.

The Huntsville (Ala.) Electric Company is reported as to put a new incandescent outfit in its electric light plant.

The Bristol Foundry and Machine Works, at Birmingham, Ala., are preparing to add some new machinery.

The citizens of Boise City, Idaho, have subscribed $10,000 subsidy to secure the location of a $35 000 woolen-mill.

A Marion (Ohio) party has made a proposition to establish an iron foundry and machine shop in Winchester, Tenn.

The Riverside Iron Company, of Wheeling, W. Va., is preparing to build an addition 240x100 feet to its tube works.

There is a report that the Salisbury cotton-mills, Salisbury, N. C., propose increasing their capital to erect another mill.

The Eliot Frog and Switch Company, of East St. Louis, Mo., is about to enlarge its shops by an addition of 40x140 feet.

Gastonia, S. C., is to have a cotton factory. A. C. Somerville and others have organized a stock company for the purpose.

It is stated that the Eufaula Improvement and Security Co. contemplates the erection of a cotton-mill at Eufaula, Ala.

The Caraleigh Mills Company, Raleigh, N. C., has decided to erect a cotton-mill of 10,000 looms, with full equipment of spindles.

At Suwanee, Ga., parties are prospecting, with a view of establishing a steel plant to manufacture steel by the direct process.

J. D. Wright & Sons, Brooklyn, N. Y., issue a circular in which is illustrated and described the friction shaper made at their works.

It is stated that efforts are being made for the organization of a $100,000 stock company, to erect a cotton-mill at Blacksburg, S. C.

The Rome (Ga.) Gas Light Co. will, it is stated, put new machinery in, and increase the capacity of its electric light and gas plant.

The Huntington & Big Sandy Railroad Company will erect at Central City (P. O. Huntington, W. Va.,) roundhouses and machine shops.

An Ohio iron manufacturing company is reported as having made a proposition to erect an iron furnace and rolling-mill in Trenton, Ga.

A company has been organized at Renfrew, Ala., with a view of encouraging the establishing in that town of a rolling-mill and pipe works.

The Cincinnati Southern Railroad Company (office, Cincinnati, Ohio,) is reported as to move its Somerset machine shops to Burgin, Ky.

Efforts are being made for the establishment of an electric light plant at Kingston, Tenn. A. B. Anderson, mayor, can give information.

The Southern Pin Company has been organized at Hickory, N. C., and will manufacture articles of wood and metal. Capital stock, $10,000.

A Northern party will, it is reported, erect an ice factory, at Fernandina, Fla., at a cost of $10,000. J. C. Perine can probably give information.

A large force is at work on the railroad machine shops extension at Clarendon, Tex., and the new machinery will soon be placed in position.

The new foundry of Dougherty Brothers, at Lowell, Mass., will, it is said, be furnished with machinery to run by electricity, at a cost of $35,000.

The Scott Machine and Hardware Company, at Denver, Col., are enlarging premises to double former size, and will put in several new tools.

The Anniston (Ala.) Pipe Works have resumed operations with about 75 or 80 men at work, and this number will be increased in a short while.

A company recently organized, with most of its stock placed, expects soon to commence the erection of a plant for making steel, at Denver, Col.

R. C. Commander, James Allen, P. A. Wilcox and others, have incorporated the Florence Iron Works, with a capital stock of $10,000, at Florence, S. C.

It is reported that the Rochester (N. Y.) Car Works will remove their plant to Johnson City, Tenn., and will expend $100,000 in establishing it.

Rumor says that $150,000 has been subscribed to establish a locomotive works at Alabama City, Ala. The total capital of the company is to be $500,000.

The Hyer Sheenan Electric Motor Company has been incorporated at Stafford Springs, Conn., to manufacture motors, governors and other specialties.

The West Virginia Central & Pittsburgh Railway Company will enlarge their machine works at Elkins, W. Va., with a view of adding the manufacture of cars.

It is stated that Howard & Sears contemplate the establishing, at New Castle, Va., of a plant for the manufacture of steel by the Adams direct process.

L. M. Hoffman, L. L. Suggs, W. Matthews, and others are the incorporators of a $30,000 stock company to erect a 4,000 spindle cotton factory at Dallas, N. C.

Parties are corresponding relative to the establishment of a $130,000 engine works in Norfolk, Va. The Secretary Chamber of Commerce can give information.

A $250,000 plant, for the manufacture of machinery, is reported as to be erected at Harriman, Tenn. The Harriman Manufacturing Company can give information.

G. W. Seller and C. B. George have incorporated, it is stated, the Paris (Ky.) Ice Manufacturing and Cold Storage Co. to erect an ice factory and cold storage plant.

Negotiations are pending at Corsicana, Tex., for the erection of a stove foundry and machine works, at the cost of $150,000. Eastern and local parties are interested.

D. E. Jones & Company have leased the old Eagle foundry, Little Rock, Ark., and will manufacture their own fans for their cotton elevators, and make other castings.

Engineers are now engaged at Irongate, Va., laying out the site for an 80-ton blast furnace, the construction of which will be commenced as soon as the plans are matured.

Negotiations are now in progress for the establishment of a foundry and pipe works, at New Birmingham, Tex. The New Birmingham Iron and Land Co. is interested.

A company has been incorporated, with a capital of $30,000, to establish a cotton factory of 4,000 spindles at Dallas, N. C. C. H. Little can give information regarding it.

The machinery for a large pipe factory has arrived at Abingdon, Va., and awaits the construction of the building, which has been let by contract, and is rapidly being completed.

W. A. Steere, of Boston, Mass., is now organizing the Pell City Cotton-mill, at Pell City, Ala. The company has been chartered in Massachusetts, with a capital stock of $400,000.

The O. L. Packard Machinery Company, of Milwaukee, Wis., has filed articles of incorporation, signed by W. S. Williams, Fred. H. Kappe, Fred. Hildibrand and James Morrison.

A hardware manufacturing company is corresponding relative to the establishment of a $30,000 plant in Norfolk, Va. The secretary Chamber of Commerce can give information.

The Cold Rolled Steel Company, of Pittsburgh, Pa., will apply for a charter on April 21. The capital stock of the company will be $50,000. The plant at Pittsburgh is almost completed.

A stock company is reported as organized, with Thomas Swafford, president; Daniel Swafford, vice-president, and John Gallagher, secretary, to erect a saw-mill at Worthville, Ky.

At Newport, Ky., L. H. Wilson, J. M. Raney, W. W. Worcester, and others, have incorporated the Worcester Wire Mfg. Co., for the purpose of manufacturing wire goods; capital stock, $12,000.

It is stated that B. J. Soper, of Malone, N. Y., has purchased a controlling interest in the Elliott Car Works, at Gadsden, Ala., and that $100,000 will be expended in improving and enlarging same.

Martinsburg, W. Va., has induced the Common Sense Engine Company, of Springfield, Ohio, for a consideration of $25,000 and five acres of land, to locate in the former place, and employ 250 hands.

Northern capitalists will, it is reported, erect a steel rail-mill in Dayton, Tenn., provided the city take stock in the company and donate site. The Tennessee Industrial Land Company is interested.

The W. Dewees Wood Company, of McKeesport, Pa., is making good progress in the erection of the iron building for its new heavy sheet-iron mill, which will be in operation probably next summer.

The Reynolds Iron Works has been incorporated, at New Orleans, La., as the Reynolds Iron Works Company, Limited, with W. H. Reynolds, president, and J. S. Reynolds, secretary. The capital stock is $40,000.

Bonnot Brothers, of Louisville, Ohio, have made a proposition to parties to take $60,000 worth of stock in a $100,000 company for the purpose of establishing boiler and engine works at Big Stone Gap, Va.

The Southern Wood Manufacturing and Creosoting Company, Limited, has been incorporated, with a capital stock of $100,000, for the purpose of creosoting wood, erecting saw-mills, etc., at New Orleans, La

A. L. Soulord, E. A. Hoffman, Jr., F. L. Kilpatrick and others, have organized the Bridgeport Electric Light and Ice Co., to erect an electric light plant and ice factory at Bridgeport, Ala. The capital stock is $60,000.

The National Malleable Iron Co. has been incorporated at Peoria, Ill., with a capital stock of $100,000, to manufacture malleable iron, machinery and implements, by Andrew Henry, Albert Angier, and George A. Wilson.

W. C., L. and E. F. Lanier, operating the West Point (Ga.) Foundry, have incorporated the West Point Iron Works, to establish iron works, electric light plants, construct water-works, etc. The capital stock is $50,000.

There is water works agitation in Newburyport, Mass.; Sparta, Mich.; Marshville, Wis.; Torrington, Conn.; Auburn, Neb.; Kent, Wash.; Duluth, Minn.; Pana, Ill.; Waco, Texas; Riverside, R. I.; Dayton, Wash.; Crockett, Texas.

The Friedensville Zinc Company is negotiating with the Bethlehem Iron Company for the purchase of a piece of property bordering on the Saucon Creek and Lehigh River at Shimersville, Pa., for the erection of a large plant.

Articles of incorporation have been filed by the Northwestern Engineering and Machinery Co., of St. Paul, Minn. The capital stock is $50,000, and the incorporators are: Charles A. Daigh, W. G. Strickland and J. M. Badger.

There is a statement current to the effect that the Scottish Middlesborough Land Company, Limited, have been organized, with a capital stock of $1,000,000, to establish iron works, rolling-mills and pipe works at Middlesborough, Ky.

The Harriman (Tenn.) Wrought-iron Company has been organized, for the purpose of building an experimental plant for manufacturing wrought-iron direct from the ore. The Harriman Manufacturing Company can give particulars.

The Davis Coupling Equipment Company, with a capital stock of $100,000, has been incorporated at Albany, N. Y. The company will manufacture automatic car couplers and attachments at Cortlandt, Westchester County, N. Y.

It is reported that the mammoth machine shops of the Richmond & Danville Railroad will be moved to Charlotte, N. C., this month. The repairing department will be the first to arrive. The grounds and buildings are being prepared.

The Danville Foundry and Machine Co., of Danville, Ill., has been incorporated, to do a general foundry and machine manufacturing business; capital stock, $75,000. The incorporators are: William Stewart, Mary Stewart and L. A. Chesley.

John Svenson, 11 Coal Exchange, Scranton, Pa., has issued a catalogue of a drawing table of his invention; also a tool for draftsmen, called the multilinead, which serves the purpose of several tools. The circulars contain a number of commendatory letters.

It is stated that negotiations are pending for a cotton factory, locomotive works, rubber works, and steel works, to manufacture steel by the Adams direct process, to be erected at Chattahoochee. The Chattahoochee Land Company, of Atlanta, Ga., is interested.

The South Florida Foundry and Machine Company, at Orlando, Fla., has been reorganized as the South Florida Foundry and Machine Works; capital stock, $150,000. It is stated that the company will erect a new building and put in $15,000 worth of machinery.

The Wheeler & Tappan Company has been incorporated at Chicago, Ill., to manufacture and deal in steam pumps, machinery, and appliances. The concern has a capital stock of $15,000, and its incorporators are: Thomas J. Wheeler, Amos K. Tannan, and F. J. Griffen.

The Norfolk (Va.) Supply Company, with a capital stock of $50,000, has been incorporated by B. D. Groner, president; T. E. Elliott, vice-president, and F. J. Bain, secretary, for the purpose of establishing machine shops for the manufacture of railroad, steamboat and other supplies.

The Dustin-Hubbard Manufacturing Company, Fort Payne, Ala., has reorganized with J. P. Dornvirtha, president, and N. Whaley, vice-president; changed company's name to the Fort Payne Machine Works, and will put plant in operation. Additional machinery has been put in.

The Kitts Steam Alarm Co., Oswego, N. Y., has issued an 1891 catalogue of steam specialties, such as high and low-water alarms, pressure boiler feeders, pump governors, steam traps, damper regulators, reducing valves, etc. The catalogue is illustrated, and contains description of specialities.

Steps have been taken toward the erection of a large factory in West Lynn, Mass., for the projectile department of the Thomson Houston Electric Works. The projectile department is connected with the United States Works, and when it is in full operation will require between 1,200 and 1,300 men.

The Betts Machine Company, Wilmington, Del., have issued a very neat and substantial catalogue of machine tools, comprising tools for machine shops, boiler shops, car shops, etc. The catalogue is printed on heavy paper, of a fine quality, and has a strong cover; it will be preserved by those securing it.

The Pueblo Iron Foundry Company, F. P. Lehner, proprietor, at Pueblo, Colo., are now erecting a fine machine shop, 44x160. This will be equipped with modern tools. The foundry department will be still further improved, and present capacity for melting iron be doubled. When completed, 16 to 20 tons can be melted per day.

The Gastonia Foundry and Machine Shop Company have been organized, at Gastonia, N. C., with a capital stock of $25,000. The officers of this company are: J. B. Beal, president; Miles Hanna, vice-president, and J. R. Spencer, secretary. This company contemplate the early construction of an iron foundry and machine shops.

The Damascus Steel Company, of Portsmouth, O., has decided to locate works in Denver, Colo., a new organization having been formed between the company and several capitalists of the latter city. This company manufactures steel tools. Its new works will cost in the neighborhood of $250,000, and will employ several hundred men.

A party of capitalists, representing the National Safe Deposit and Vault Manufacturing Company, of Pittsburgh, and representatives of the Chicago Safe and Lock Company, recently interviewed Youngstown (Ohio) capitalists, proposing to build a large safe factory at that place. They desire to capitalize the new concern at $350,000.

The Osgood & Willey Co., Potter Building, New York, has entered upon the somewhat novel business of establishing what may be called a buyers' exchange. The company will put correspondents, free of charge, in the way of finding where to buy anything whatsoever that they may want, seeing that they get catalogues, and other desired information.

The new rolling-mill for The Washburn & Moen Mfg. Co., at Waukegan, Ill., will be quite extensive. The main building will be 140 feet in width by 400 feet in length, with a wing on one side 40 feet in width and 160 feet long, and one on the opposite side 40 feet in width by 100 feet long. The building will be entirely of steel, designed and built by The Berlin Iron Bridge Co., of East Berlin, Conn.

The Cooper Boiler and Engine Company, of St. Johns, Mich., employing about fifty hands in the manufacture of boilers and engines, has decided to move its plant to Muncie, Ind. The company has been manufacturing only small boilers and engines, but it is the intention on moving the plant to Muncie to increase the facilities and manufacture all sizes up to as large as fifty horse-power. A general machine shop will be added to the business.

The Shendun Machine and Repair Works were recently incorporated by citizens of Shendun and Port Republic, Va. The president of this company is E. R. Armentrout; W. L. Harper, secretary and treasurer, and S. E. Boyd, superintendent. This company is now erecting at Shendun, a large, corrugated iron building, 108x105 feet, where 75 men will be employed, when in operation, repairing engines, boilers and other machinery and agricultural implements, as well as manufacturing many articles in iron and wood.

The organization of the Standard Boiler and Bridge Works, of Bellaire, Ohio, will take place as soon as it can be done, according to law. The lumber for the buildings and other material has been purchased, and the erection of the building will be pushed as rapidly as the weather will permit. Mr. J. Jarrold, at present superintendent of the Carroll-Porter Boiler and Tank Company's works, of Pittsburgh, will be manager of the new works. The machinery will be ready to place in position shortly, and the new company will be ready for business soon.

Passed Assistant Engineer [of the navy] John A. Tobin is the inventor of a bronze metal, which has received much attention and general approval of its merits in its specified uses for certain machinery of all the new cruisers constructed or in course of construction. It is now being manufactured for the Government by the Ansonia Brass and Copper Company, and experience shows that it can be forged and stamped as readily as steel; that it can be drop-forged in the same manner as steel; that it possesses great tensile strength, toughness and elasticity when drawn into wire; that, in the manufacture of gunpowder, its unliability to give off sparks makes it valuable, and the result of the tests, in comparison with other metals, shows many advantages.—*The Tribune.*

The largest shipment of gold mining machinery that has ever been shipped at one time from this city has just been shipped to Golden, Col. A Pueblo banking company contracted with J. & J. B. Milholland, of Fifth avenue, in October last, for one of the largest mining plants this firm has ever taken. It was contracted in October, as above stated, and was shipped on Saturday. The plant consists of engines, drums, sheaves, shafts, and one of the Lambing patent booms, and two of the largest excavators of Mr. Lambing's patent, with a great deal of other work specially made by the above-named firm for mining purposes. The weight of the entire shipment was 180,000 pounds, or about seven car loads. A most singular feature about this shipment was that it was shipped by river from here in place of by rail. The above firm are now negotiating for two or three more plants about the same as the one just shipped. The Milhollands make a specialty of wire rope haulage machinery, and are now building three to be shipped to various parts of the country, and are endeavoring to induce as much of the far Western trade to come to Pittsburgh as possible; yet it is found that freights handicap our home industries for that trade quite a good deal.—*Pittsburgh* (Pa.) *Telegraph.*

Friction of a Pivot Bearing.

At the recent meeting of the Institution of Civil Engineers (England) the first paper read was the "Fourth Report of the Research Committee on Friction." The following abstract of it is taken from *London Engineering:*

The experiments on the friction of a foot step bearing were made at Messrs. Simpson & Co.'s works, Pimlico. The bearing experimented on was flat-ended, and 3 inches in diameter. The vertical shaft carrying the footstep was geared to a horizontal shaft which was driven by a belt from the shafting of the works. The bearing was pressed upwards against the footstep by an oil press

with a plunger 6 inches in diameter. This plunger was made a good but perfectly free fit in its cylinder for a length of 9 inches, a number of grooves being turned in the cylinder throughout its whole length at close intervals. Connected with the footstep was a circular plate which had a groove turned in its periphery; a small chain lay in the groove round a portion of the circumference, from whence it led off to a spring balance attached to the fixed frame of the apparatus; so that the rotation of the plate stretched the spring balance, and the force tending to turn the plate was thereby indicated. The upper end of the vertical shaft that carried the footstep had a piston fixed on it, which revolved in a cylinder 6 inches in diameter. This upper cylinder was connected by a pipe with the cylinder of the lower press, so that, whatever oil pressure there was in the lower cylinder pressing the bearing upwards, there was the same in the upper cylinder pressing the footstep downwards. The footstep having been set running at the desired speed, the pump was worked until the pressure gauge on the oil press indicated the desired pressure; and the friction was then read off the spring balance. The first method of lubrication tried was by introducing the oil through a hole in the center of the bearing, and distributing it through two radial grooves. The oil rapidly overflowed at the top of the bearing, and fell again into the lubricating pipe, the bearing acting as a pump, and giving a rapid circulation of oil. As long as the oil ran dirty, it ran to waste, while fresh clean oil was supplied to the lubricating pipe. When it became clean the circulation was established. Experiments were first tried at 50, 128, 194, 290, and 353 revolutions per minute. The friction was plotted on a diagram in inch-pounds. The coefficient of friction was obtained by dividing the friction in inch-pounds by the product of the load multiplied by the area of the bearing. From geometrical considerations two-thirds of the radius of the bearing was taken as the radius at which the force of friction acts. At 50 revolutions per minute, the coefficients of friction varied between .0181 and .0221; at 128 revolutions between .0053 and .0113; at 194 revolutions between .0051 and .0102; at 290 revolutions between .0044 and .0178; at 353 revolutions between .0053 and .0167. Generally the coefficients decreased as the friction increased. After the experiments with the steel footstep on manganese bronze, a white metal bearing surface was substituted. A set of experiments were taken at 128 revolutions per minute, the coefficient of friction was a little larger with the white metal than with the manganese-bronze. At the higher speeds the coefficient of friction was less, owing to the more perfect lubrication, as shown by the more rapid circulation of the oil, and at the higher speeds with medium loads it was in several cases under 0.0050 or $\frac{1}{200}$th. The manganese-bronze and the white metal bearings were tested for endurance at 128 revolutions per minute. The former bearing heated and seized on one occasion with a load of 260 pounds, and on another occasion with 300 pounds per square inch. The white metal bearing under similar conditions heated and seized with a load of 240 pounds per square inch. The steel footstep on manganese bronze was afterwards tried, lubricating with three and with four radial grooves; but the friction was from one and a half times to twice as great as with only the two grooves.

O. P. Hood, superintendent and professor of mechanics and engineering in the Kansas State Agricultural College, Manhattan, Kansas, writes: "Just now we have in our wood-working shop 192 young men every day, learning the use of wood-working tools. We expect to put up a good iron shop this coming summer, with new engine and a full complement of iron-working tools. I should like very much to receive catalogues of the goods manufactured by your advertisers, as I must select the necessary tools soon."

Buffalo Continuous Shear.

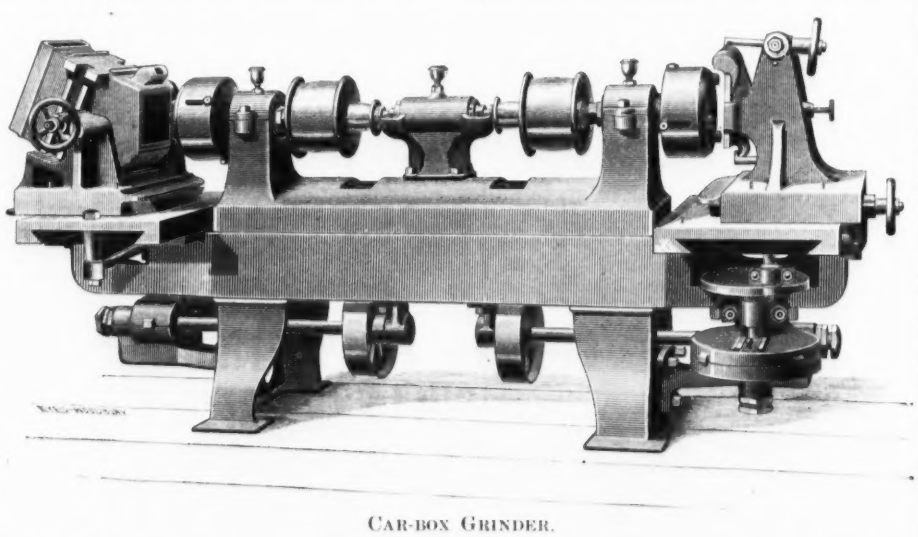
The hand shear of which we give an illustration has recently been placed upon the market by the Buffalo Forge Company, Buffalo, N. Y. It is especially designed for boiler and other shops where an effective hand shear is required. The arrangement of the levers is such as to form a powerful knuckle joint, and by each vibration of the hand-lever the tool is made to shear, thereby giving what the builders call a continuous shear. A great efficiency is claimed for this machine, based upon actual tests and continuous service for several years before it was placed upon the market. The tool is made in four sizes to shear $\frac{1}{4}$-inch plate-iron up to $\frac{5}{8}$ inch. All parts are interchangeable. The manufacturers have also brought out a combined tool, consisting of a punch, shear and bar cutter, its general mechanism being similar to that of the shear. The operator can either use the punch, shear or bar cutter, without a helper, and no adjusting is required in changing the work. Substantially the same mechanism is also applied to a hand-punch made by this company.

BUFFALO CONTINUOUS SHEAR.

Recently an ocean steamship brought over 34,500 letters for New York City. These were received at the New York Post-office at half-past four in the morning, and were all in the hands of the letter carriers at half-past seven.

Car-box Grinder.

The compact and substantial machine shown in our illustration is especially adapted for facing off or finishing, with emery wheel plugs, the surfaces of journal-boxes, etc. The emery wheel chuck contains three emery plugs, which are held tightly against the outside edge of chuck by means of a cam. The emery plugs rest against a block which is held by a screw, and can be fed forward as the plugs wear away. Each end of the machine supports a carriage which moves over dovetail ways gibbed to take up the wear. A crank-pin and disk fed by a worm and worm gear gives a reciprocating motion to the carriage, causing it to move at right angles to the axis of the wheel. The work is held in a chuck which moves in the direction of the axis of the emery wheel on dovetail ways attached to the carriage. The automatic feed towards the wheel is obtained by means of a feed screw actuated by a ratchet wheel and pawl; it can be adjusted to feed at any desired speed, or the pawl can be thrown out, and the carriage fed backward or forward by means of the hand-wheel on the end of the feed-screw. The weight of the machine is 2,065 pounds; height from floor to center of spindle, 30 inches; length of bearings, 5 and 3½ inches; diameter of spindle, 1⅝ inches; spindle pulleys, 7½ inches; diameter and length of emery plug, 1¼ by 3¾ inches; floor space, 30 by 73½ inches; driving pulley on countershaft, 28 by 8 inches; tight and loose pulley, 10 by 6 inches; length of chuck, 4 inches, and will take in work 7 by 7 inches. These machines are patented. They are manufactured by the Springfield Emery Wheel Mfg. Co., Bridgeport, Conn.



CAR-BOX GRINDER.

In our issue of Jan. 22, 1891, we published a letter from a mechanical superintendent to his brother, a young man who was proposing to learn the machinist's trade. The letter was full of good advice from a man of experience; so much so, that Gould & Eberhardt, machine tool builders of Newark, N. J., have republished it in neat little book form for distribution among their workmen. We have no doubt the little book will do good.

Railroad companies have been held to strict accountability in many ways, but their difficulties will be increased by a recent decision in Texas to the effect that a railway train must stop when the engineer sees a dog on the track, or take the consequences in a suit for damages, if the dog is killed. This decision would have astonished the old jurists who held that a dog could not even be the property of an individual, so that a person could be convicted of larceny in stealing it. The trial judge in the Texas court told the jury that the railroad employes were not required to stop the train if the circumstances reasonably justified the belief that the dog would get out of the way, but if it appeared that the dog would be struck unless the train were stopped or the speed slackened, and the employes did not use proper care to stop the train, the company would be liable. The lawyers for the railroad company sought to secure a court for the killing of a cow. The lawyer for the company was greatly surprised at the decision, and expressed his wonder with some emphasis. The justice said that the company was negligent in not putting up a signboard with the words painted on it: "Look out for the locomotive." "But the cow could not have read that," said the lawyer. "Very true," said the justice, "but it would have been much worse for the company if a person who could have read it had been killed, and under all the circumstances the company gets off very easily."—*The Tribune.*

A good deal of grumbling is done by the press of this country because railroad employes refuse to give information in case of a wreck or other accident. Second thought will convince most people that they do exactly right in this matter. It is nothing but loyalty to the company that employs them.

The fact that within a few weeks three of the old navy hulks were wrecked, and three of the new steel cruisers went aground so often that it is thought advisable to dock them, does not inspire implicit confidence in naval seamanship.

Machinists' Supplies and Iron.

NEW YORK, April 11, 1891.

Iron—American Pig—The general tone of the market is one of dullness. It is not a question of price, but the material is not required. Many well-informed persons in the trade express the opinion that a sharp turn will come all of a sudden, as the position is nearly ripe for it.

We quote No. 1 Foundry, Standard Northern brands, $17 to $18; No. 2 is selling at $15.75 to $17; and Gray Forge at $14.25 to $15. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; $15.25 to $16 for No. 2, and $14 to $14.50 for No. 3.

Scotch Pig—We quote Coltness, $24.50; Dalmellington, $22; and Eglinton, $20.50.

Copper—The market has not been influenced by recent bullish reports, and it is said that 13¾c. to 13¾c. will still buy Lake Copper, the nominal price of which is 14c. Casting Copper is firm at 11½c. to 11¾c.

Lead—Buyers continue to bid 4.30c. for large quantities on spot and near by, while holders demand 4.32½c. to 4.35c. There seems to be no fresh business, and prices may be called nominal.

Spelter—The market is lower on account of the price of ore being reduced from $27 and $28 to $23 at the mines. Smelters are slow, however, in granting concessions, and continue to quote 5.10c. for shipments.

Tin—The market is quiet and easier. For spot delivery 20.20c. is bid, and 20.25c. asked.

Antimony—The market is barely steady.

We quote Hallett's, 16c. to 16 1-3c.; Cookson's, 17½c. to 18c.; and L. X., 16c.

Lard Oil—The market is barely steady at 53c. to 55c. for Prime City, according to holder and quantity.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Energetic young machinist desires change for improvement. Address Nestor, AM. MACHINIST.

Wanted—To correspond with capable machinists accustomed to fitting up lathes. Address W. S., care of AMERICAN MACHINIST.

Wanted—A position as supt. or foreman of boiler shop; long experience, temperate, best of reference. S. G. Orghard, 227 St. Louis avenue, Chicago, Ill.

Foreman of machine shop wishes change of position; screw machine or general work preferred. A1 reference. Address Change, AMERICAN MACHINIST.

A good draftsman and machinist, capable of looking after a small shop, wants a position; best references. BOX 80, AMERICAN MACHINIST.

Good mechanical draftsman wants position in N. Y; has also had experience on architectural work and superintending; references. No. 172, AM. MACH.

First-class draftsman and designer wants position, with an opportunity for advancement; references. Intelligent, AMERICAN MACHINIST.

Wanted—A situation by a first-class molder on loam, dry or green sand; loam preferred; capable of taking charge of shop; best of references. BOX 79, AMERICAN MACHINIST.

Wanted—Foreman for brass finishing department on valves, cocks and specialties; must have executive ability, and be familiar with modern tools. Address, stating salary req'd, BOX 75, AM. MACHINIST.

Wanted—Established machine tool manufacturer, East, to make, on contract or royalty, a special line of machine tools; patterns complete; trade established. Address Wire, AMERICAN MACHINIST.

Wanted, Machinists—Three vise and three lathe hands on wood-working machinery; steady employment for good men. Defiance Machine Works, Defiance, Ohio.

A Swedish mechanical engineer, intending to make a trip to Europe this summer, should like to act as agent for a first-class firm in the machinery line. Address "W. U.," AMERICAN MACHINIST.

A practical draftsman and pattern maker, with long experience designing and superintending the construction of jigs, and tools for close interchangeable work, desires a position as foreman or superintendent. Address Jachin, AM. MACHINIST.

Wanted—Position as supt. or foreman, by a young man, 36, successful in the systematic manufacture of machinery and mechanical devices, and in the economical management of men; a designer and draftsman of automatic and interchangeable machinery, tools, jigs, etc. W. H. S., Box 197, Burnside, Conn.

Wanted—Foundry foreman; one skilled in heavy work of all kinds, in loam, dry and green sand work; must be well up in this line, and strictly temperate; permanent position and good wages to right man. Address, giving experience and reference, Bole, 624, Columbus, Ohio.

A first-class mechanical draftsman, young, with good experience both over the board and on outside work, superior designing ability, and good general business qualifications, wants position where ability and industry will insure advancement. References. Mech. Eng., P. O. Box 2538, N. Y. City.

Wanted—An active man as foreman or supt.; one up in modern machine shop practice, and handling men; must understand engine construction; one having experience in pumping machinery preferred; state age, experience, and salary expected. Address Box 73, Am. Machinist.

Wanted—A first-class tool designer and maker to take charge of the designing and making of tools for small work; will have charge of thirty tool makers; steady employment and good salary to a strictly first-class man; no other but one of experience in small and close work need apply. Address National Cash Register Co., Dayton, Ohio.

A mechanical engineer and draftsman, with eight years' experience as superintendent and master mechanic in shops manufacturing small interchangeable machinery and fine tools, wishes to make a change from present position; south of Virginia or Southern California preferred. Address G. W. N., Box 35, Sharon Hill, Delaware Co., Pa.

Wanted—A thoroughly competent foreman for a machine shop in Ontario, Canada, in a live railway town, making mowers, reapers, binders, horse rakes and plows. From 60 to 80 hands in that department. None but experienced men, accustomed to agricultural implement work, need apply. Must be quick at figures, and understand all the latest methods of doing work cheaply and to advantage. State age, and salary expected. Apply to Box 78, American Machinist.

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

For Sale—At a bargain, well-established machine shop in South Jersey doing a good business on new work and general repairs. Sold only on account of ill health. Address Box 77, American Machinist.

Wanted—One or more parties to purchase with the advertiser a desirable part of the manufacturing business of an old-established concern, who has not the room or facilities to continue it. An opportunity is here offered for a profitable investment, the purchasers to take an active part in the management or not, as may be arranged. Location, a flourishing city of 135,000 people in New York State. Address Enterprise, American Machinist.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

STEEL TUBES
WELDLESS
SMOOTH · COLD DRAWN
John S. Leng's Son & Co. New York.

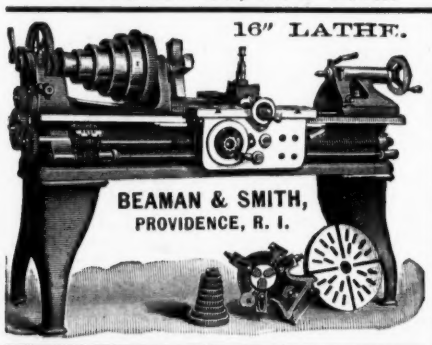
"TIME IS MONEY."

"The smith his iron measures
Hammered to the anvil's chime."—Longfellow.

"And his **BRADLEY HAMMER** treasures,
Since it saves him work and time."—Some-other-fellow.

2000 IN USE. PLEASE INVESTIGATE.

BRADLEY & CO., SYRACUSE, N. Y.
14 Warren St., New York. 96 & 98 Sudbury St., Boston.



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—AND—
MANACEMENT.
By ANGUS SINCLAIR, M. E.,
17th Edition, 12mo., Cloth, $2.00
JOHN WILEY & SONS, NEW YORK.

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CASTINGS.
GENERAL MACHINE WORK.
CORRESPONDENCE INVITED.
ALLENTOWN FOUNDRY & MACHINE CO.,
3d and Walnut Sts., Allentown, Pa.

WHAT DO YOU WISH TO BUY?

We will furnish, without cost, Catalogues and Price-Lists of all the leading houses in the U. S. who deal in the article you want.

OSGOOD & WILLEY CO.
Potter Building, New York City.

MANUFACTURERS
with an established business who are desirous of removing their works to a place within an hour of New York City; with good water front for sites; with water and rail transportation, and most attractive for residence, will find it to their advantage to address
STAMFORD BOARD OF TRADE,
Stamford, Conn.

THE DE LAMATER IRON WORKS,
(Incorporated 1889.)
Foot West 13th St., *NEW YORK,*
MANUFACTURERS OF
GENERAL MACHINERY,
Having acquired the Steam Pump business, formerly carried on by C. H. De Lamater & Co., offer both single and duplex Steam Pumps at very low prices.

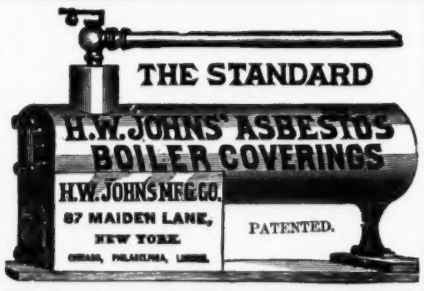
C. H. De Lamater & Co. offer for sale the following tools:
2 25 ton Traveling Cranes.
1 18 " " "
1 Horizontal Boring Mill, 62"x18'.
1 Heavy conbined Punch and Shear.
Large lot of Lathe and Planer Tools, Wood Pulleys, Propeller Wheels, and three 700 lb. Binary Ice Machines.

FOR SALE.
The following new boilers were in our shop at the time of our fire, and will be offered cheap to close out:

Two 12 H.P.	Vertical	Boilers.
One 10 "	Locomotive	"
Two 15 "	"	"
One 25 "	"	"
One 35 "	"	"
One 40 "	"	"
One 20 "	Return Tubular	"
Two 54 "	Two-flue	"

One Boiler for Consolidation Locomotive.

Richmond Locomotive & Machine Works,
RICHMOND, VA.



ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

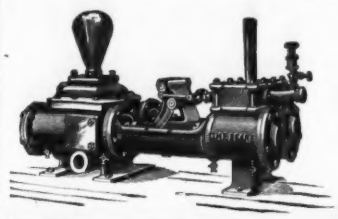
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.

The American Machinist March 19, quoting from *Mechanical Progress*, says:

"We don't hear so much of late of the 'perfection' of cast gears, and the benefits of the hard scale or surface left on the teeth. This sort of engineering twaddle did very well when appliances were wanting for cutting the teeth of gears cheaply. It was making a virtue of necessity."

We have especially good facilities for
GEAR CUTTING
and can furnish
CUT GEARS
(in quantities,) at prices that will compare favorably with those of Cast Gears. Correspondence solicited.

LELAND, FAULCONER & NORTON CO.,
DETROIT, MICH.



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STEAM PUMPS
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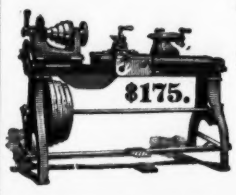
MAKERS OF
FINE **STEEL**
For Dies, Punches, Taps, Reamers, Cold Chisels, Lathe Tools, Shear Blades, Milling Cutters, Etc., Etc.



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Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO.,
167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

TOBIN BRONZE
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive
CAN BE FORGED HOT.
Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.
ANSONIA BRASS & COPPER CO.,
Sole Manufacturers
19 & 21 CLIFF ST., NEW YORK.
Send for Circular.

FINE TAPS, DIES, REAMERS, Etc.

LIGHTNING AND GREEN RIVER *Screw Plates.*
Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.
WILEY & RUSSELL MFG. CO., GREENFIELD, MASS. New York Office, No. 126 Liberty St.

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All Kinds in Stock.
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We want Manufacturers. This is a splendid point; one of the best in the U. S. for the **Manufacture of Machinery.** Cheap fuel. Cheap feights. Cheap raw materials. Cheaper than almost anywhere else. Free sites and liberal inducements, and incomparable advantages are offered. Write for prospectus and particulars. Address
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LENGTHENS LIFE OF NEW BELTS.
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WATERBURY, CONN.

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THE D. FRISBIE CO.,
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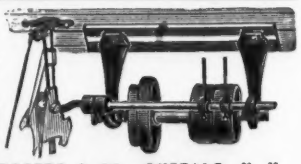
FOR RENT.
In the best Natural Gas City in Indiana, Buildings with heat, light and power, equipped with automatic sprinklers, steam heat and electric light; suitable for light or heavy manufacturing.
Address JAS. BOYCE, Muncie, Ind.

One Pull
One Way
to either start or stop machine.
Self-locking belt and clutch shifter; fits any bar now in use.



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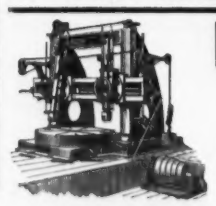
MANUFACTURERS OF
WILSON'S EUREKA BABBITT.
THE BEST ANTI-FRICTION METAL EVER OFFERED TO THE TRADE.
Satisfaction Guaranteed in Every Case.

INCOMBUSTIBLE MACHINERY
Wiping Material, much cheaper and better than Cotton Waste. Consumers and dealers should write for particulars to Borden & Remington, Fall River, Mass., U. S. A.



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COMBINING EVERY IMPROVEMENT.
14 Sizes—From 5 to 20 feet.
BETTS MACHINE CO.,
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NICHOLSON FILE COMPANY,

PROVIDENCE, R. I.

FILES AND RASPS

FOR EVERY VARIETY OF WORK.

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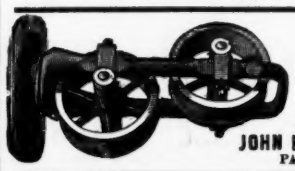

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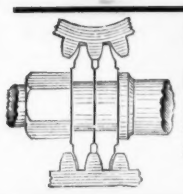

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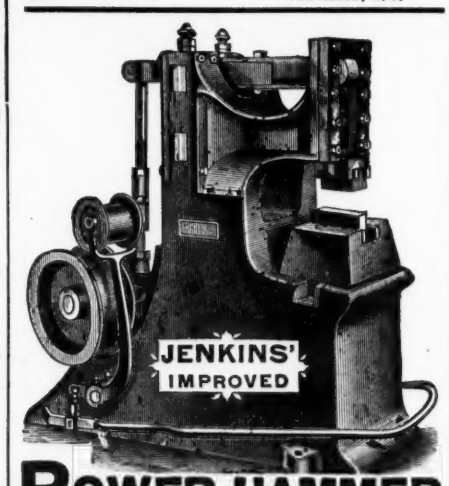

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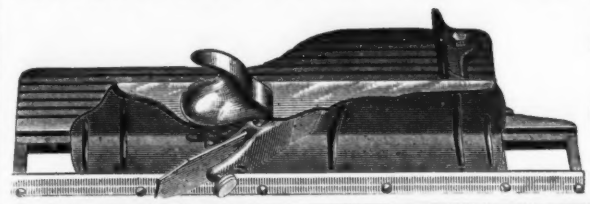

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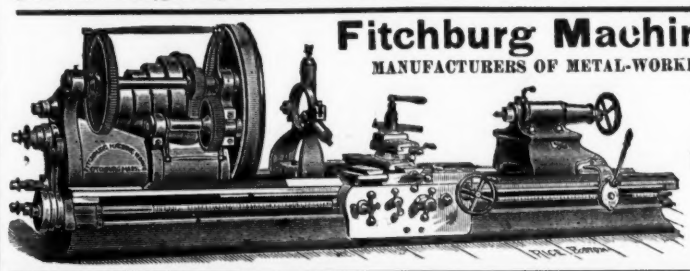

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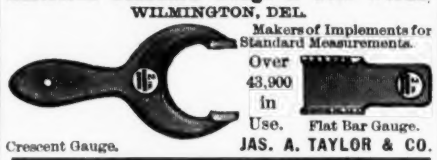

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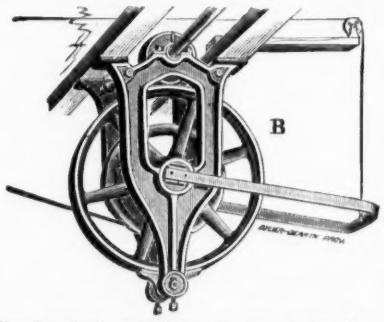

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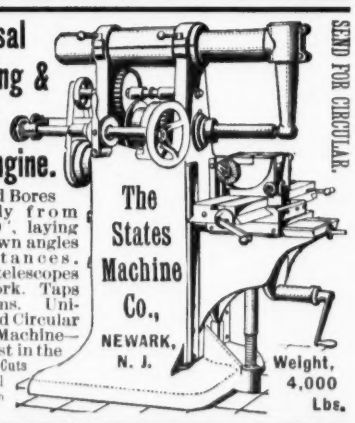

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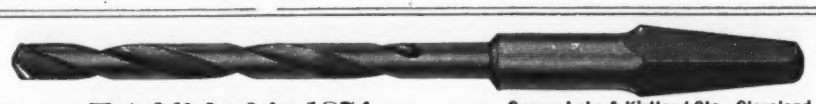

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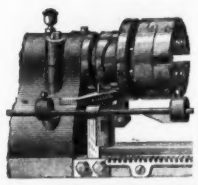

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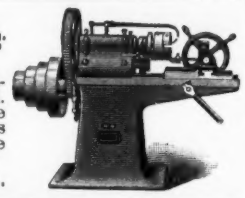

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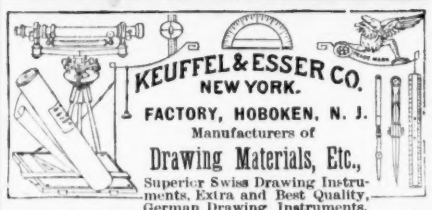

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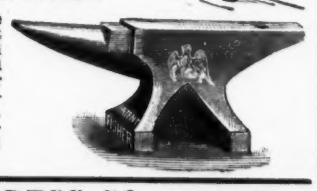

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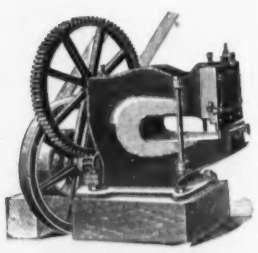

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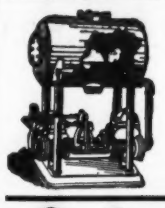

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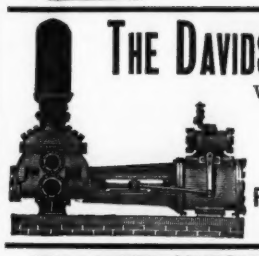

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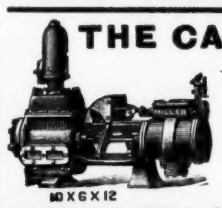

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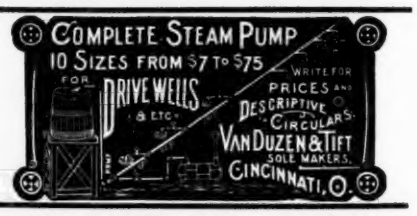
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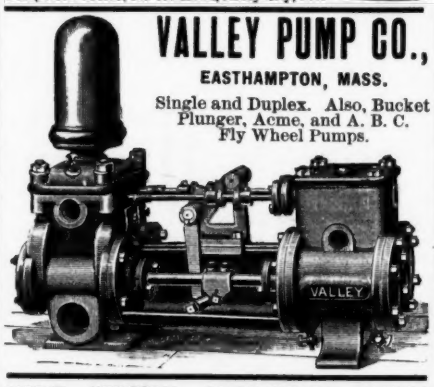

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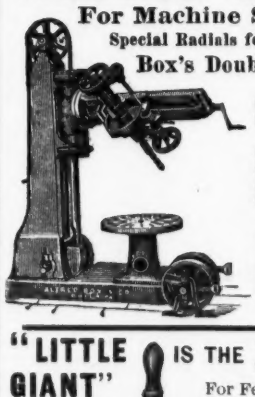

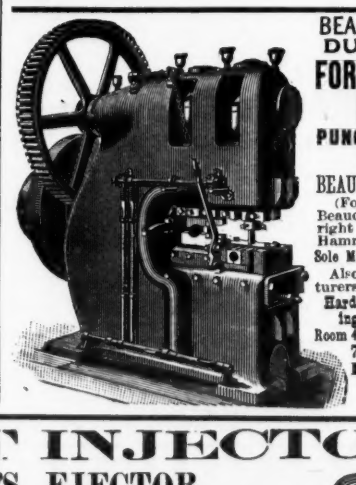

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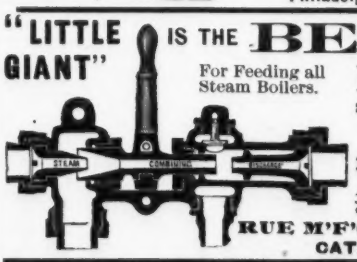

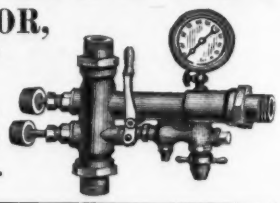

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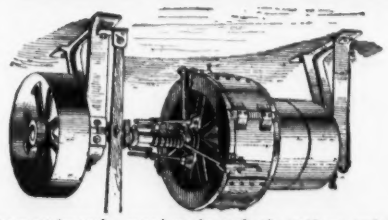

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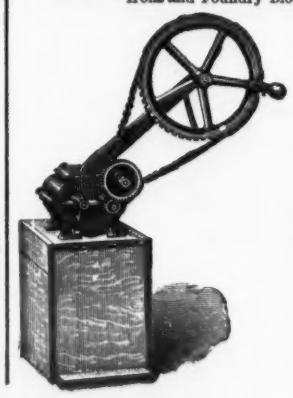

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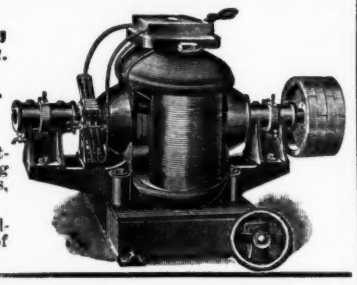

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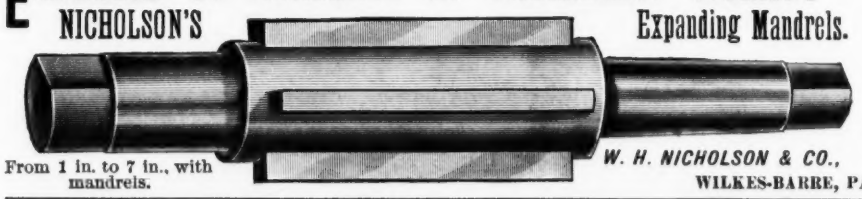

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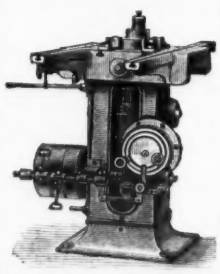

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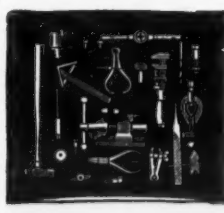

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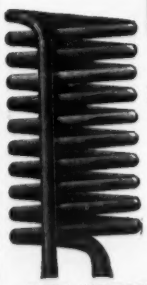

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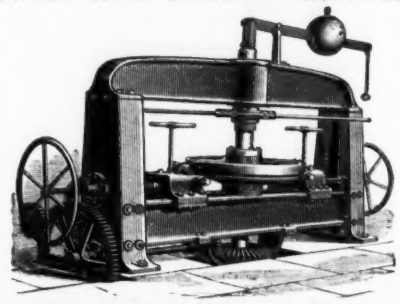

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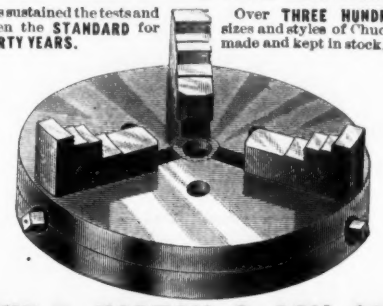

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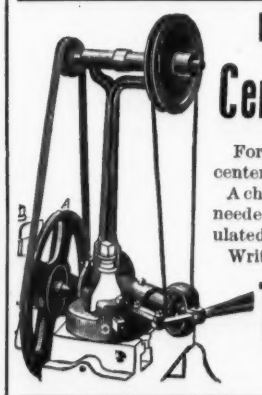

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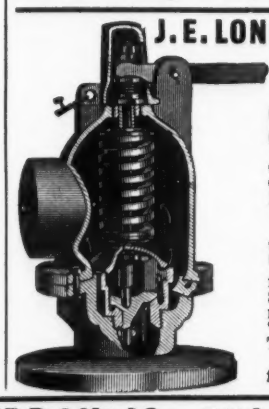

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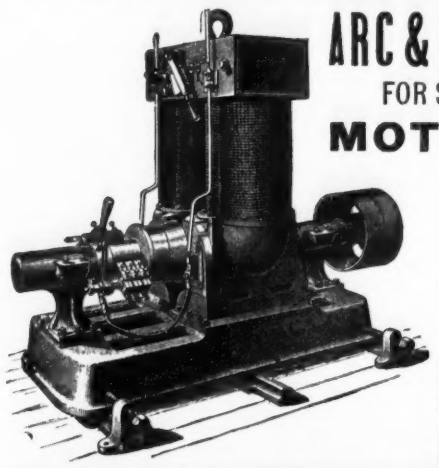

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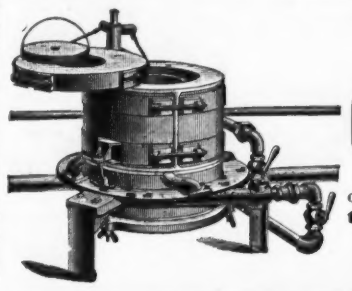

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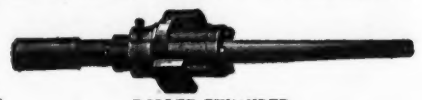

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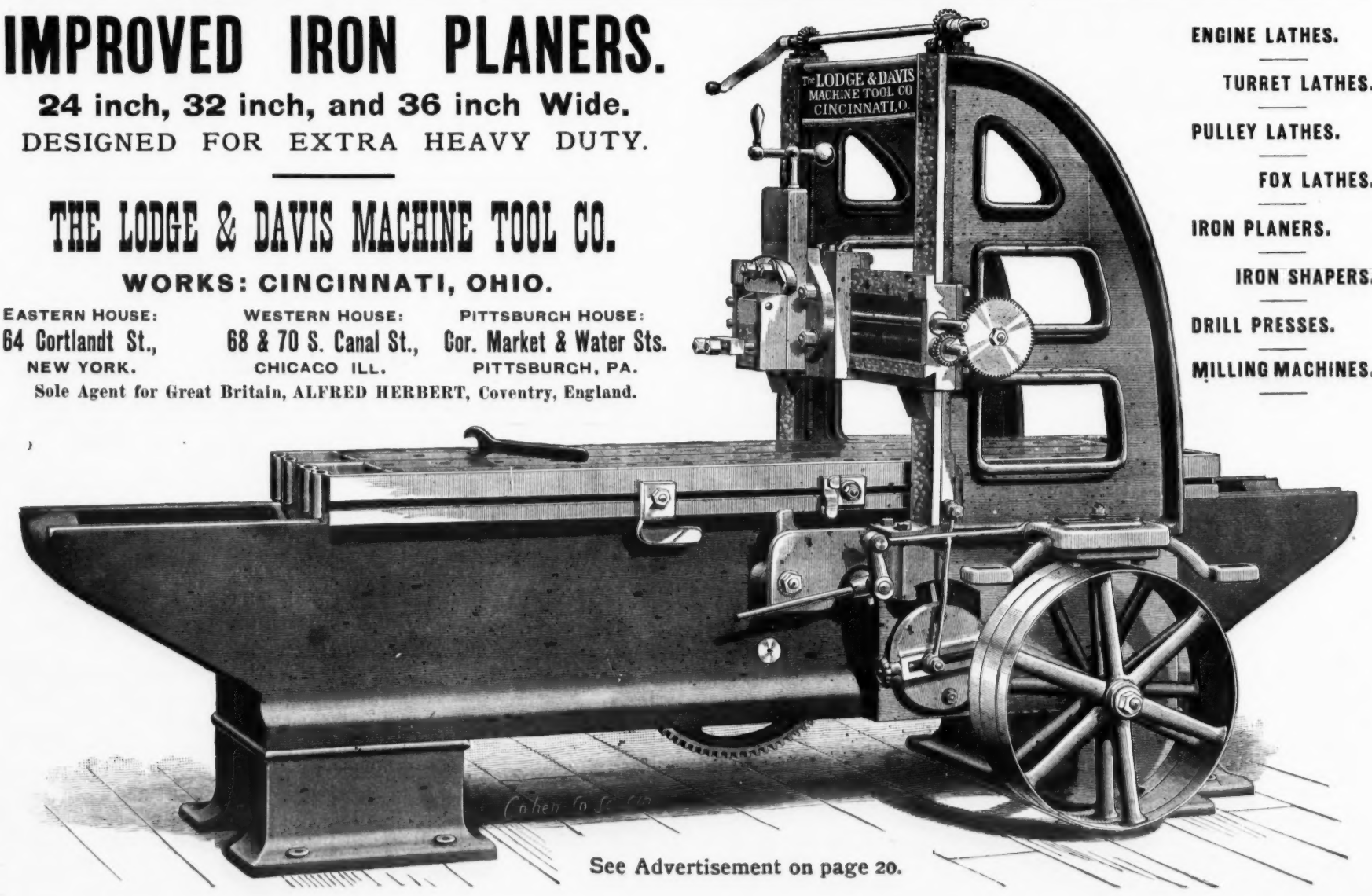

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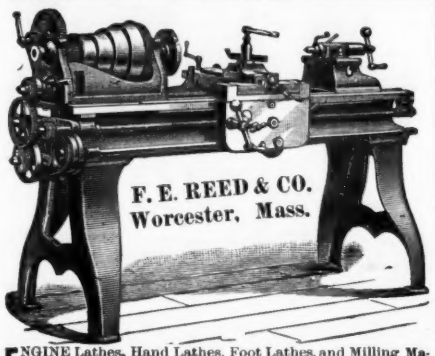

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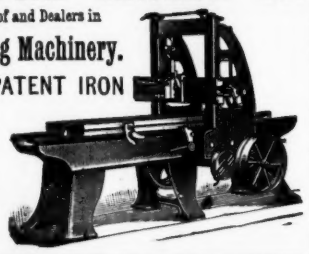

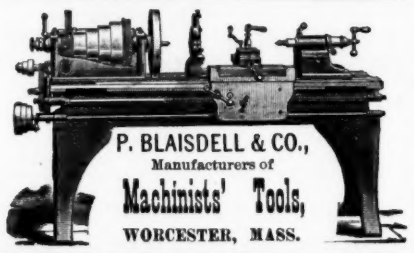

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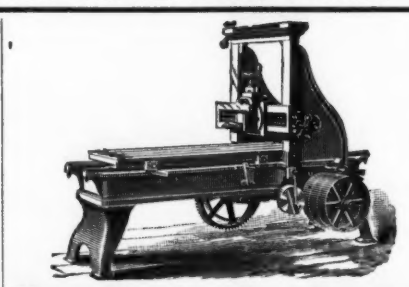

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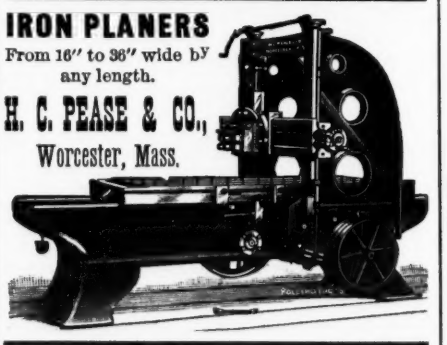

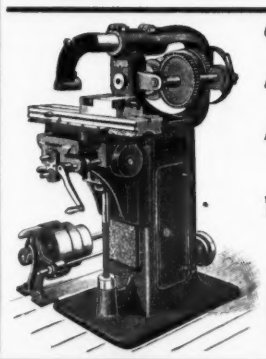

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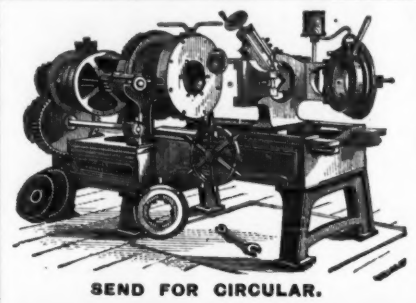

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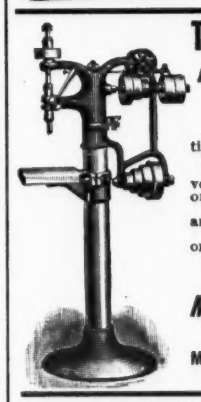

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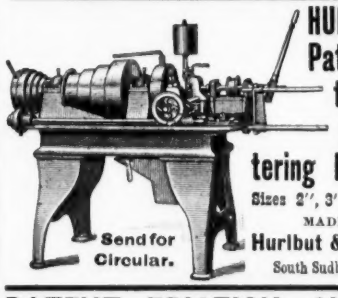

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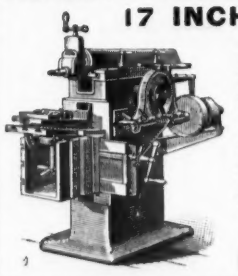

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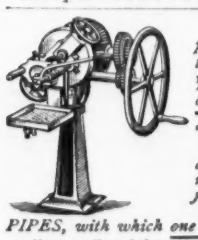

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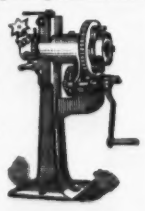

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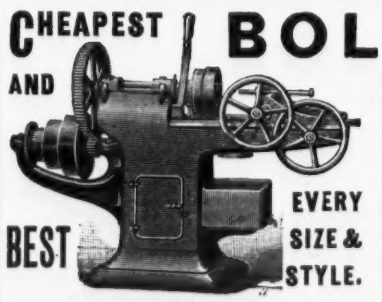

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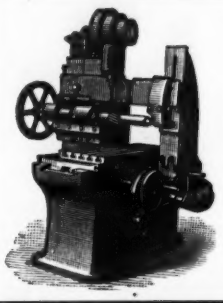

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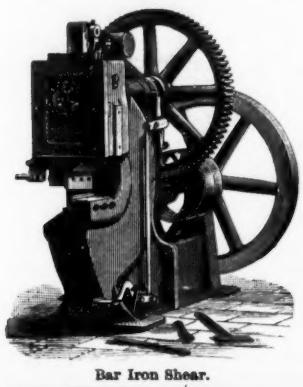

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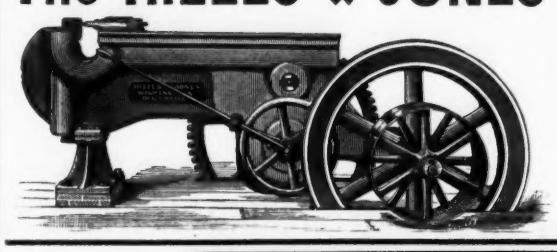

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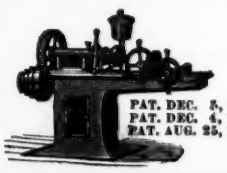

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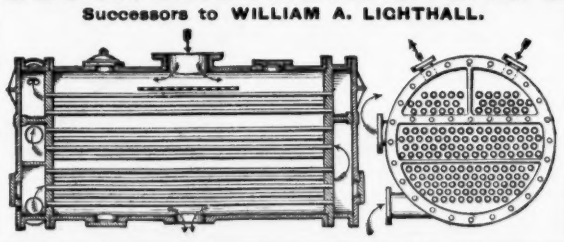

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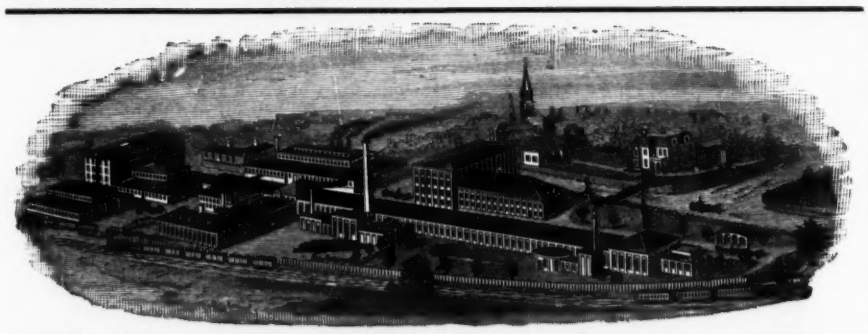

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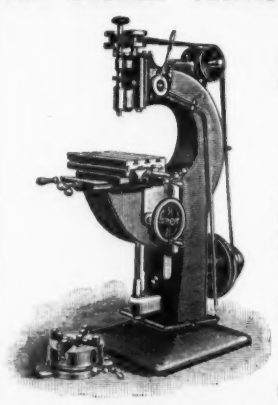

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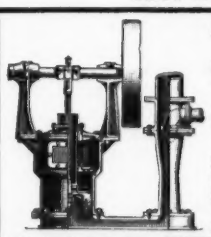

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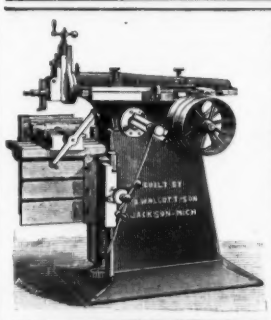

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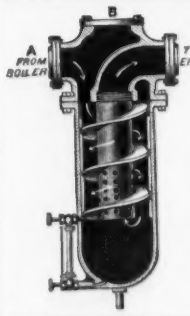

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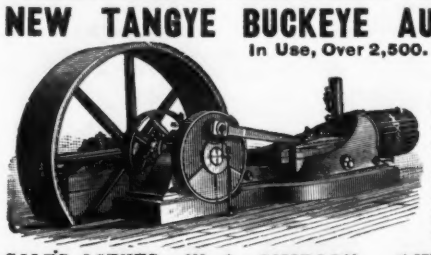

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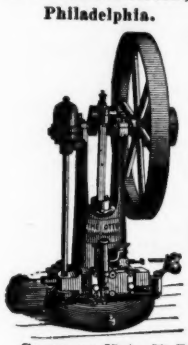

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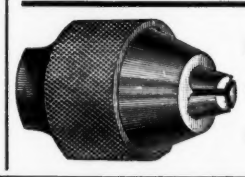

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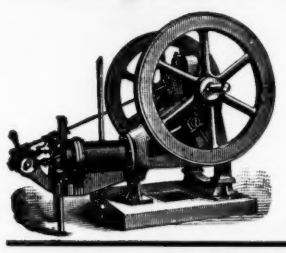

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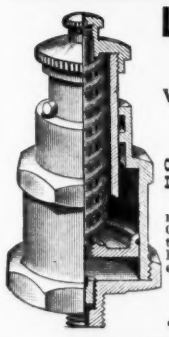

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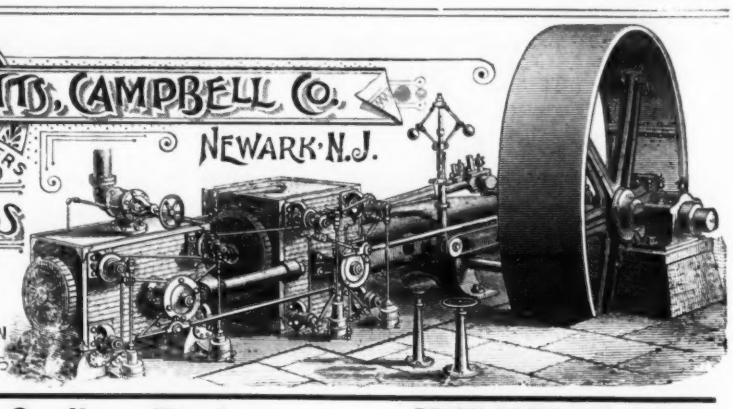

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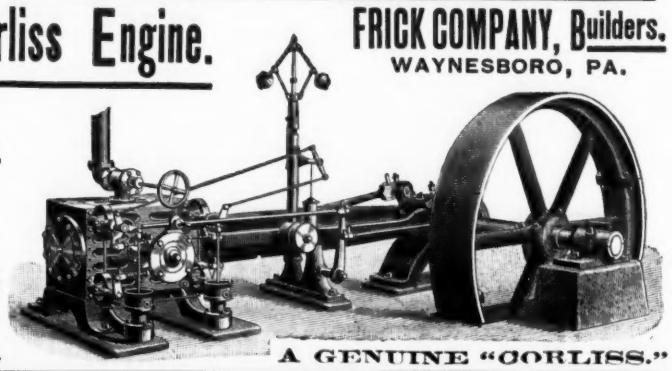

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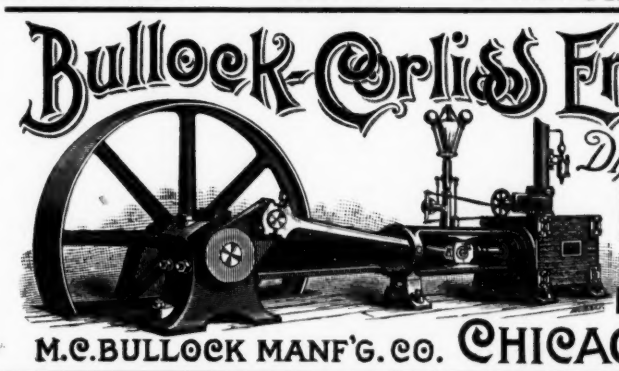

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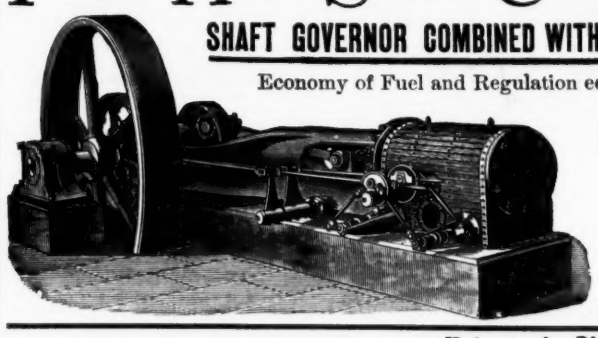

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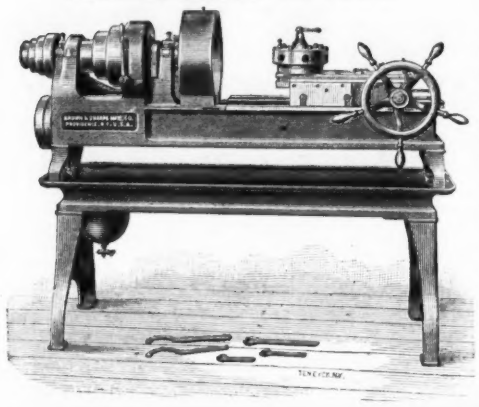

The head is back-geared and has a patented clutch for changing from belt to back gears without stopping the spindle. The gears are underneath the spindle cone and entirely enclosed. The spindle and boxes are steel. The end thrust is taken by the rear box.

The turret is fed automatically or by hand, and, as each of the four speeds given by the feed cones may be varied by shifting the lever without changing the belt, the tools may be fed fast or slow for each belt of the cones, giving eight speeds in all. The turret is 9⅛" diameter, and has seven holes 1¼" in diameter. Movement of the turret head slide, 9½". Swing over bed, 15'. Length of bed, 66". Depth that can be drilled, 6". Weight about 1,800 lbs.

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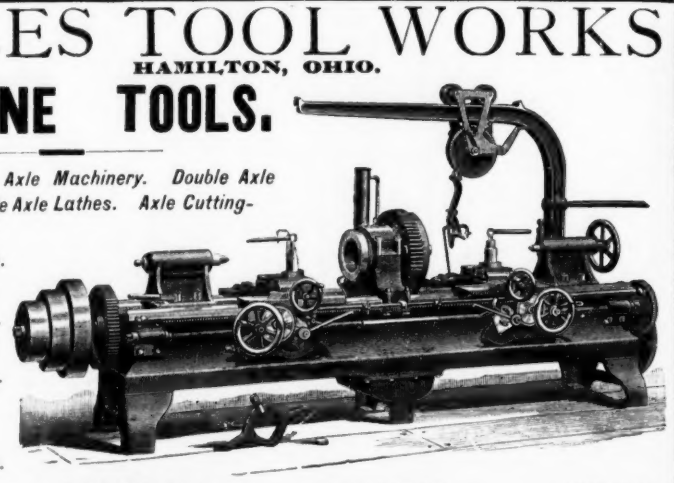

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N. B.—See "Advertisement," page 16.

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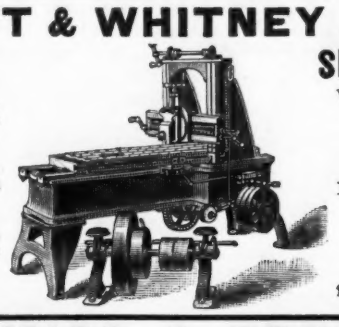

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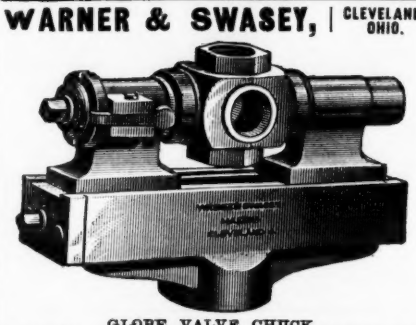

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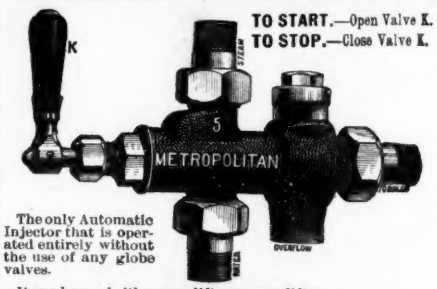

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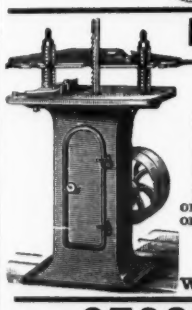

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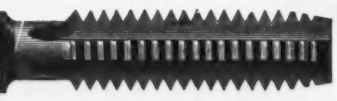

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